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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 11.

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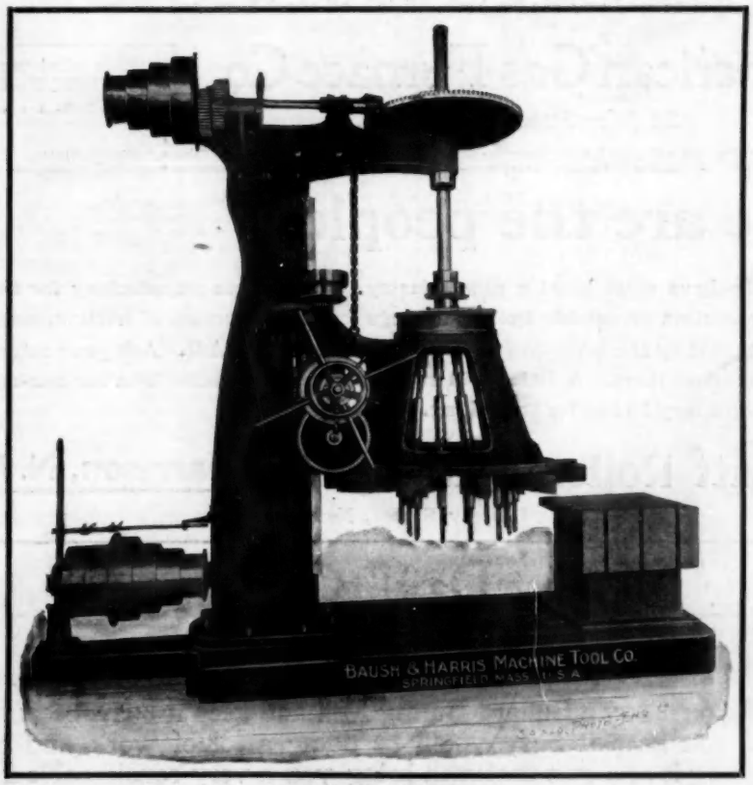

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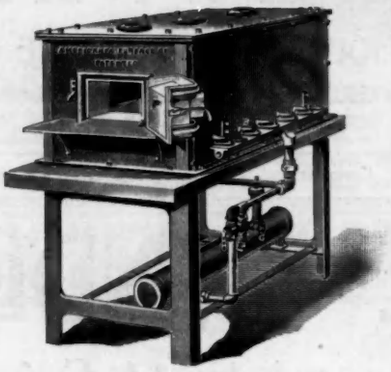

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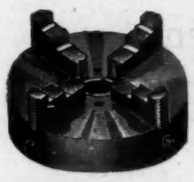

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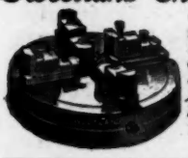

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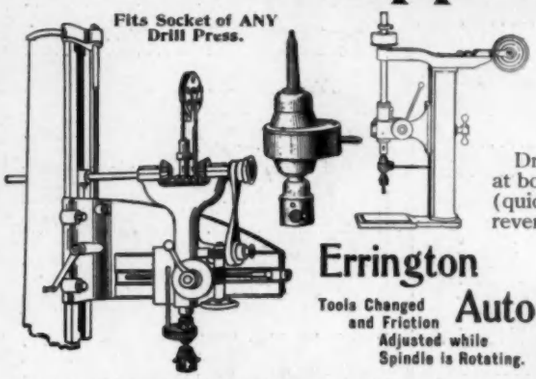

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, MARCH 16, 1899 NUMBER 11

Patterns for Crane Cheeks—I.

BY JOSEPH HORNER.

One of the principal patterns for a crane is the side frame, or cheek, of which there are two, right and left. These carry the girders or stretchers, the cylinders and engine gear, hoisting drum, post of jib and other attachments. A side frame is always filleted on the outside, and sometimes on the inside. It is better to keep the inner face plain and free for the facings which receive the cross girders and other attachments. Small crab cheeks, which have only stretchers or distance pieces, are usually filleted on both sides. The fillets impart strength to what would otherwise be a weak plate, besides improving the appearance. The patterns for side frames and cheeks are generally of a rather flimsy character, and are therefore liable to become rammed out of truth. It is necessary to guard against this, which is done in the following ways:

In plain-plated cheeks, which are seldom of large dimensions, the plated portion is made with narrow strips and open joints, the faces being maintained flush by means of dowels at short intervals. The ribs or fillets are also arranged to cross the joints, and so bind the strips together. In frames with openings, the plated portion is constructed of strips of suitable widths, fitted together with half-lap joints. The fillets are arranged as far as possible to cross over the joints, and reinforce the weak halvings.

But though a pattern is made true, it is easily rammed winding to a considerable amount, even from ½ inch to 1 inch, if care is not exercised. If the pattern is molded by bedding-in, the bed must be strickled off level and free from wind by means of a straight-edge, working across two strips bedded level and parallel in the floor. If molded by turning over, the joints of the flasks ought to be planed truly to afford a guide for the straight-edge to scrape a level bed to lay the pattern on. This is better than putting large patterns on plates. Either plates or bottom boards may be used for the smaller cheeks. But large plates or boards are not so easily kept true. They suit very well when the work is rolled over, and the box joints planed, because then a plate or a board can be cottered up against the planed joint while the pattern is rammed. The smaller patterns can well be made of cast iron, and then they need not be put on a board at all, but can be molded without risk either by bedding-in or rolling over.

The web or plate of a large open-side frame is never made in any other way, except by uniting several narrow strips together with half-lap joints. The edges of these strips are made to coincide in some places exactly, in others approximately with the outlines of the frame. Fig. 1 shows a pattern frame of this character on the filleted side, and Fig. 2 illustrates the web only, framed together, and marked out in readiness for cutting. Little description is necessary, the timber shading showing clearly the arrangement of strips and of grain.

The method shown in Fig. 2 is that which is adopted in the main essentials in all patterns of this class. The strips are prepared as narrow as practicable, in order to lessen the amount of subsequent shrinkage, and supplementary parts, corners, etc., are glued in separately. The half-lap joints are made with dovetailed rather than with parallel sides, to assist in locking the parts together. Every joint is glued and screwed. A key is inserted at the top of the frame to lessen the risk of the curving of the timber in that locality, the width being considerable. One method of insertion of the corner pieces from which several of the radii are cut is shown. Other methods are in use. These are illustrated in Fig. 3. At *A* a corner piece is dovetailed or keyed in. This is a good job when new. But such pieces be-

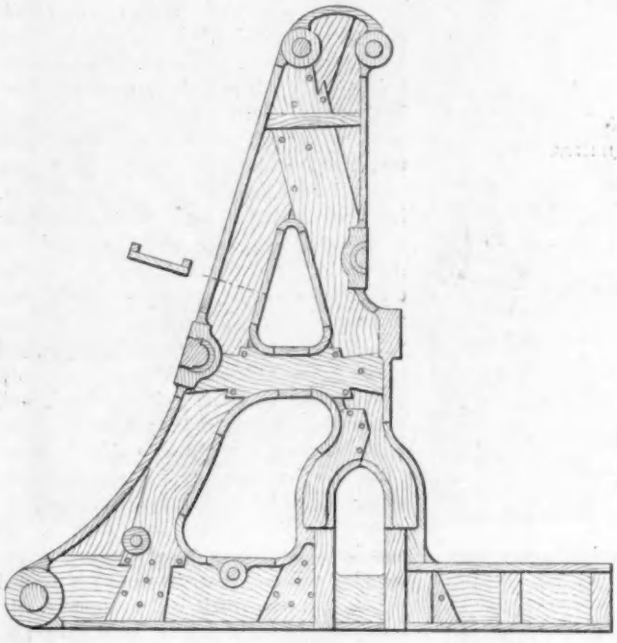


Fig. 1

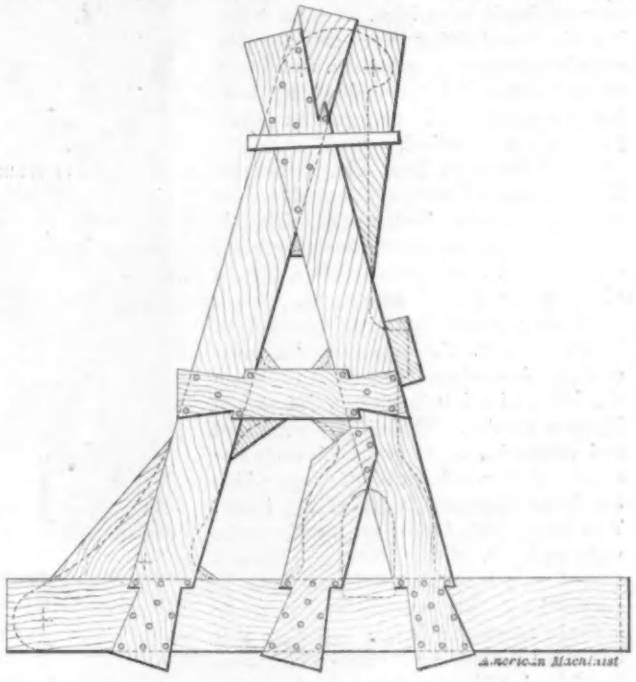


Fig. 2

PATTERN FOR A FOUNDRY CRANE CHEEK.

come loosened and broken with foundry usage. *B* is a modification of *A*, designed to avoid the evil of short grain, present in *A*. *C* is a poor method, because of the shortness of the grain. *D* is the best, and is that which is embodied in Fig. 2. The corner is glued in with the grain running vertically, and the feather edges are thus kept good. When properly glued and covered with the fillet it makes a permanent job.

After the web of the frame, seen marked out in Fig. 3, is cut to outline, the filleting and facings are prepared and glued and screwed on, completing the pattern, as in Fig. 1. Each separate piece of fillet, bearings, boss, etc., is screwed in position while rough, and with but an approximate outline from the saw. It is afterwards marked to curvature from the edge of the web or plate; removed, and worked with gouge and chisel, and its inner edges marked by gaging, or by compasses, and worked. It is then returned, glued, and screwed finally in position. A little dressing of corresponding edges and abutting ends is subsequently necessary, and finally all the screw holes are filled up with beaumontague, and the pattern glass papered and varnished.

It will be noted from Fig. 1 that the fillets, bearings, bosses, etc., are all put on in comparatively short pieces. This is done to secure the strongest arrangement of grain, and is necessary when a pattern of irregular outline has to be filleted. With long pieces short grain would be bound to occur. And although the fitting of many short pieces takes more time than the fitting of a few long ones, the pattern is more durable. These fillets are glued and screwed on. In standard work the same remark applies to the facings which are fastened on the inside of the frame. Two pattern side frames are usually made, right and left. Often, however, when a special crane is ordered, different from the standard type, one pattern side frame only is made to one hand first, and after that is molded the pattern is reversed for casting the other hand. The reversal consists in the changing of the fillets and facings from one face to the other, with any other alterations due to differences in the two frames. As the outlines of the right and left hand frames are generally alike, this is easily done. In this case, of course, nothing must be glued on, but screwed only.

Not less than two, and preferably three, coats of shellac are given to standard patterns, and from time to time the varnish requires renewal.

Then, further, proper provision is required for rapping and lifting; without which a standard pattern would soon become injured. But the web or plate is so thin that there is not sufficient hold there for the screws of the rapping and lifting plates. There are two ways then of securing the plates. One is to fasten hardwood blocks on the web on the side opposite the plates, and screw through into these (Fig. 4). The blocks will have to be stopped off in the mold. The other is to use two plates, and rivet the two together through the web. This saves the trouble of stopping-off. Either method is a good one.

In all side frames and cheeks it is better to core out bearings than to cut them

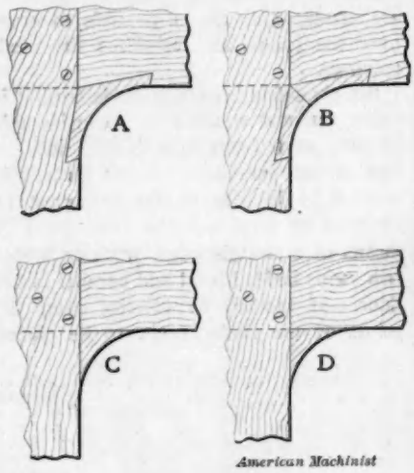


Fig. 3

DIFFERENT JOINTS.

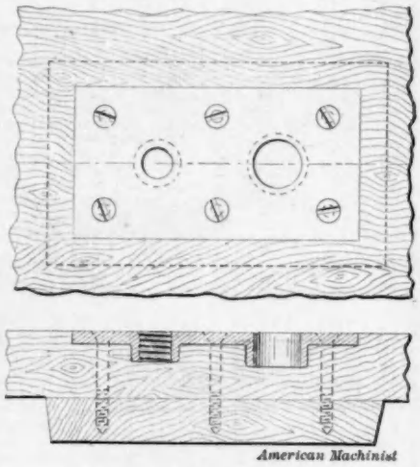


Fig. 4

SECURING RAPPING PLATE.

out. In the first place, the pattern is rather stiffer, and it is easier for the molder, because of the risk of the breaking down of the bearing spaces. It is likewise easier to make alterations in centers of shafts, should such be required, to suit gears of different diameters. In Fig. 1 the core prints for the bearings are on their top faces. They might alternatively be placed on the vertical faces. I need not illustrate the core boxes. Other round holes are cored also. The allowance for boring in all holes should not be less than ⅜ inch in diameter; ¼ inch is not enough. In large frames ½ inch should be allowed, especially if steel gears are used.

Some Points of Practice Seen in the Shops of the Cincinnati Milling Machine Company.

A mechanic whose privilege it is to visit the shops of the Cincinnati Milling Machine Company occasionally soon learns to know the place as one of the most progressive tool building establishments of the country. Not only are the shops larger almost every time they are visited than they were before, but there are always new things to be seen in them—entirely original, or perhaps partially adapted ideas designed to facilitate the production of milling machines and cutter grinders, or to still further improve the already high quality of the work done.

As previously noted in these columns, the shops have recently been again about doubled in size and capacity, and in this new portion of the buildings a system of handling the heavier portions of the work has been introduced which is somewhat different from what I have seen elsewhere. No very heavy pieces are to be handled, and for this and other reasons traveling cranes were not required. Instead air hoists are used, and these are suspended in the usual way from overhead rails with trolleys. These rails are straight and traverse the shop from one end to the other for the main lines of movement, but for serving groups of tools circular sections of the rail are introduced, as shown by the photograph Fig. 1. At the center of the circle is a post which supports one end of the steel beam upon which the trolley moves. The other end of the beam is supported on a small truck which runs upon the circular rail, and the trolley supports the air hoist in the usual manner. Only two drill presses show in the photograph, but there are really four in the group, arranged as shown by the sketch plan, Fig. 2. It will be noticed that there is a gap in the circular rail and that the ends are turned up so that the truck which supports the outer end of the swinging beam cannot be accidentally run off the rail. This gap prevents the beam from being turned continuously, or too much, in one direction, which if it happened would cut off the air supply. By this arrangement work can be deposited in front of any one of the four machines, or at any point on the floor between them, and it can also be deposited at a point at one side where an air hoist on one of the main lines can take it up to be carried to any other part of the shop. A similar arrangement is used for those lathes in which the heavier work is done, but in this case only two machines can be advantageously served; these being arranged as shown by the sketch Fig. 3.

AN INDEX WORM-WHEEL TESTING MACHINE.

One of the regular burdens which must be carried by all makers of milling machines having index heads is imposed by the extravagant ideas that many people

have as to the degree of accuracy that should be expected in the worm-wheel with which the dividing is done. This wheel, which is usually about 3½ inches diameter, is often used to cut gears or to divide other work up to about three times its own diameter, and if, on this larger work, the least error can be detected, there is usually a row about it; no allowance being made either for the fact that the wheel is not used for dividing only, as index wheels ordinarily are, but that on the universal machine it is used also for rotating the work in cutting spirals. Most people, moreover, do not reflect that, as nearly all spirals are right-handed, and so in cutting them only one side of the worm and wheel teeth are worn, the rougher indexing can also be done by rotating the index pin in the same direction, and then for that indexing which must be done with accuracy the index pin can be revolved in the other direction, and thus the unworn side of the teeth of the worm and wheel be used for such special work only.

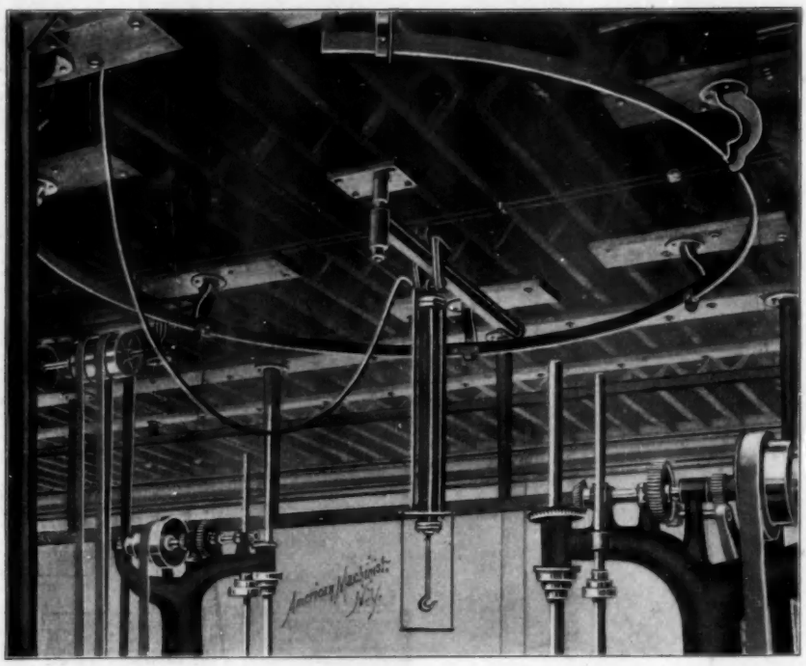


FIG. I. ARRANGEMENT OF OVERHEAD RAIL AND AIR-HOIST FOR SERVING FOUR DRILL-PRESSES.

In this shop it has been found advantageous to have at hand accurate knowledge of the exact amount of error in every worm-wheel used in an index head and sent out to customers, and in order to secure this knowledge, the machine shown in Figs. 4 and 5 was designed and built for testing the wheels. Every such wheel passes through this machine, and its errors are noted and recorded for future reference, or the wheel is condemned, according to whether or not the errors as revealed by the machine are of sufficient magnitude to make them discoverable or objectionable in the use of the machine. It is of course to be understood that no absolutely perfect wheels are to be obtained for such a purpose, and the machine here shown is intended merely to subject the wheels to a much more refined test than they can ever be subjected to in use, and to enable the errors to be accurately measured and recorded for future reference should it be desirable to refer to them. Like most machines designed and built by the man who is to use them, and which it is not expected to duplicate, this one does not of course represent Mr. Holz's ideal of machine design, but is composed of such elements of the machines regularly manufactured in the establishment as were available for the purpose, supplemented with such entirely new parts as were necessary to make the complete machine; which, after all, constitutes an example of the adaptation of means to ends which forms an important part of the science of machine design.

The column upon which the machine stands will be recognized. Upon this is fixed a plate for which a pattern had to be made. On this is secured, immovably, a milling-machine platen, to which is fitted the regular tail-center block of the milling machine, and I think the head-stock casting is also used on some milling machines for gear cutting.

A very carefully made spindle was fitted to this head-stock, and to the outer end of this spindle is fitted a large plate having in its outer edge a ring of silver dovetailed in and very carefully turned true. On this ring of silver there are graduations which were placed there by Warner & Swasey on their new dividing engine made for astronomical and engineering instruments, and which, there are some reasons for believing, is the nearest approach to perfection that has yet been attained in dividing-engine construction. These graduations are scarcely perceptible to the unaided eye, and are read by means of the microscope seen above them; this microscope being provided with the usual spider-web lines for accurately placing the graduations. For convenience in rotating the plate, there is a worm-wheel on the spindle in front of the large plate, and the worm shaft has upon it a smaller graduated dial for indicating the amount of errors which may be present in the work being tested.

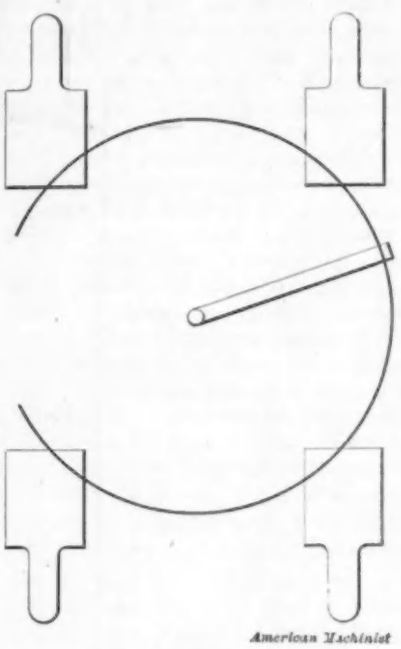


Fig. 2

SKETCH OF ARRANGEMENT OF RAIL AND HOIST FOR DRILL-PRESSES.

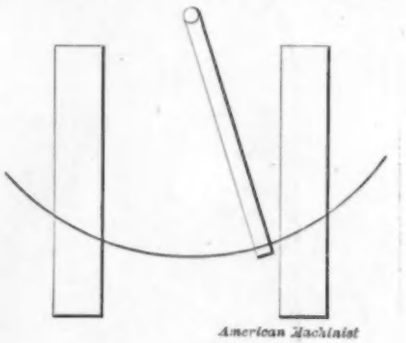


Fig. 3

SKETCH OF ARRANGEMENT OF OVERHEAD RAIL FOR LATHES.

The part of the machine shown by the drawing, Fig. 5, is one of the few parts constructed for this purpose. It consists of the frame *A* fitted to the bed, and on this is pivoted the indicating lever *b*. This lever is pivoted near its lower ex-

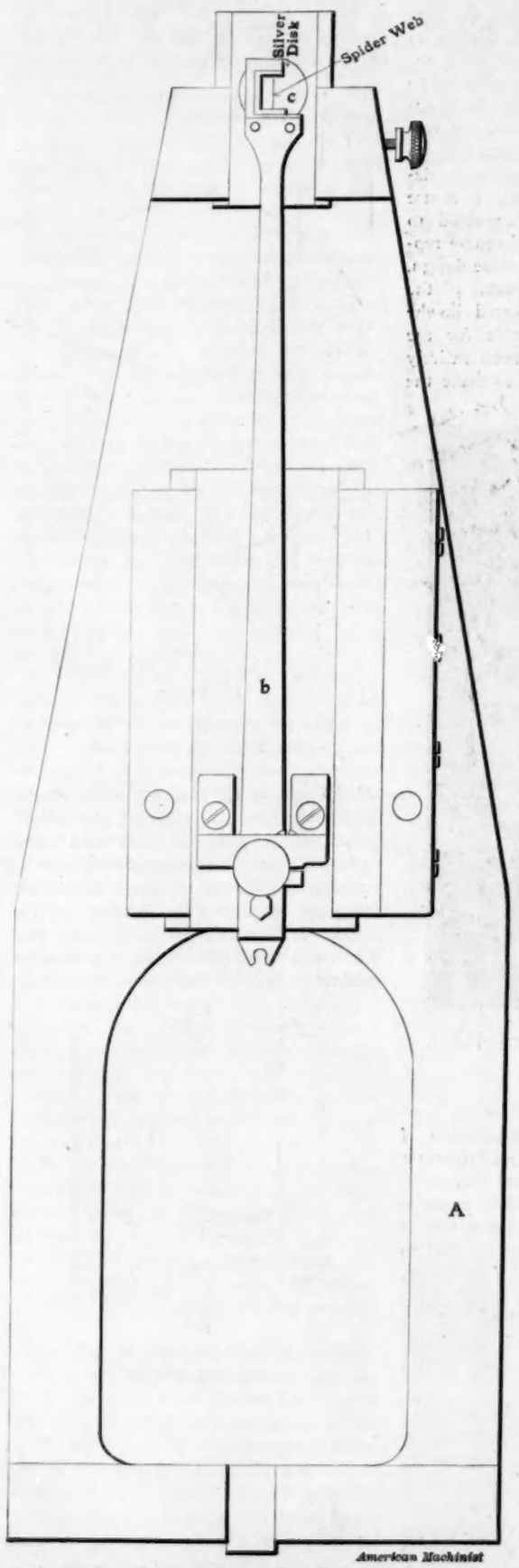


FIG. 5. PORTION OF MACHINE FOR TESTING THE ACCURACY OF WORM-WHEEL TEETH.

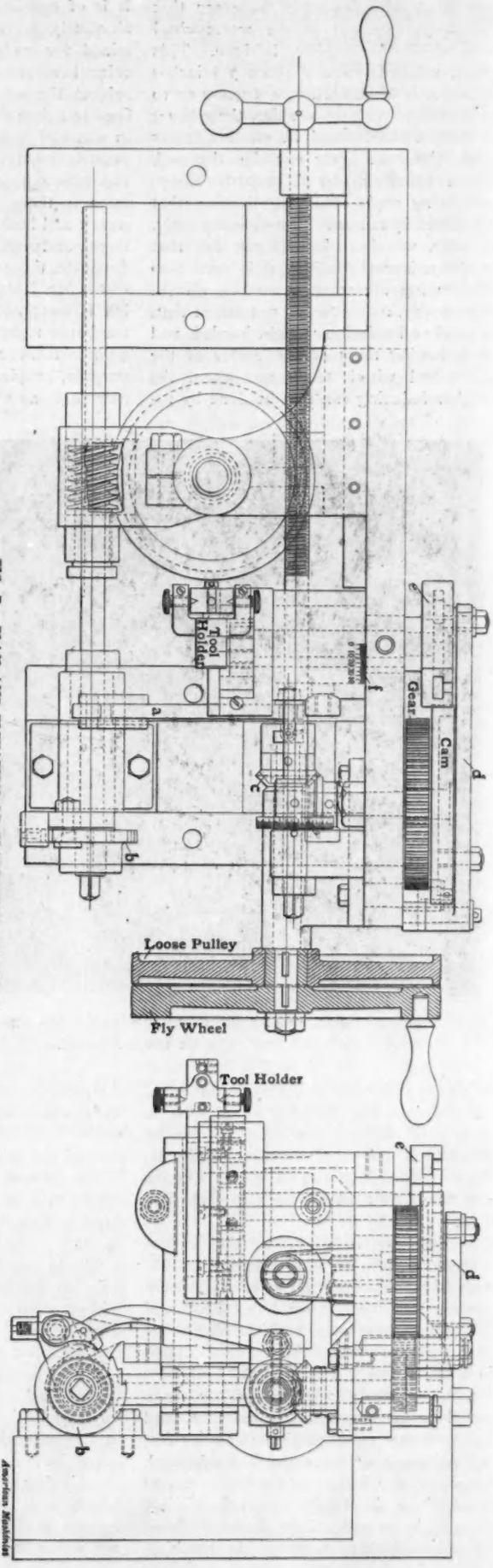


FIG. 7. PLAN AND ELEVATION OF GRADUATING MACHINE.

tremity, which is shaped as shown, so that it can embrace a tooth of the wheel being tested and touch it upon both sides. The other end, which is about eight and a half times as far away from the pivot, is provided with means for carrying a spider-web line, which, as the lever moves,

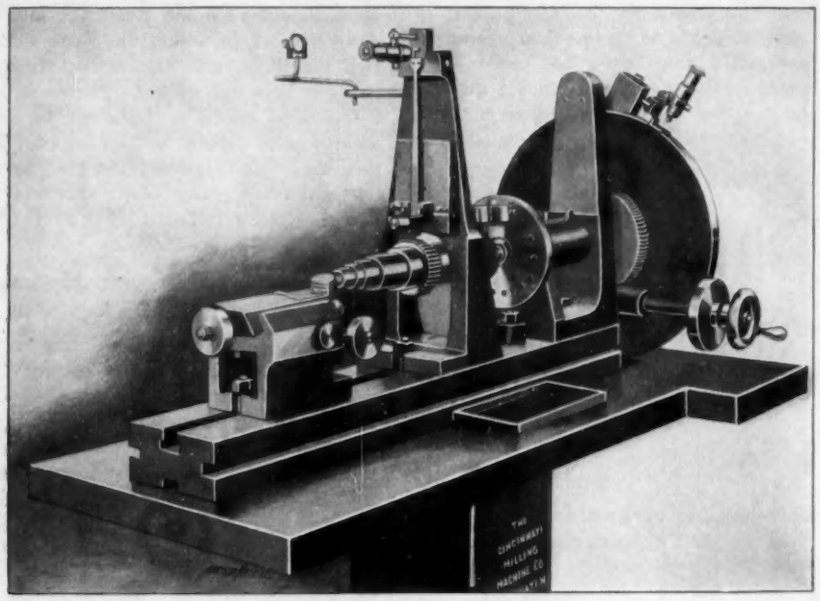


FIG. 4. MACHINE FOR TESTING ACCURACY OF WORM-WHEELS.

passes over graduations drawn upon a disk of silver. The position of this spider-web with regard to the graduations is also determined by means of a microscope with spider-web lines in the field, as shown in the photograph Fig. 4.

Placing a wheel in the machine, as shown, the lever *b* may be brought down on to the uppermost tooth by means of the slide, and then by means of the various adjustments the graduations may be made to read zero, or any convenient integral figure. After that the microscope at the right will show when the spindle has been rotated just the right amount to bring the next tooth under the indicating lever, if said tooth is correctly spaced. If it is not, then its error will be clearly shown by the graduations. Every tooth of every such wheel is thus tested, and Mr. Holz says that though he knows that very few of the users of the machine know of this refined test to which the wheels have been subjected and the degree of accuracy which is thereby secured, it is a great satisfaction to him to know that fact and to feel sure that no reasonable or well-founded criticism can be made of the wheels sent out.

GRADUATING MACHINE.

Practically every movement of every part of a modern milling machine is regulated by micrometer graduations, and besides there are a number of arcs which are graduated in degrees for indicating angular settings. This makes a great deal of such work to be done, and makes it worth while to fit up specially for doing it in a shop where so many machines of one kind are made. At Fig. 6 is shown a photograph of the machine which was designed and built here for the purpose and which may be driven either by hand or belt, and is capable of making 90 lines per minute on either cylindrical surfaces, such as is shown being operated upon, or on conical surfaces, such as is shown on the bench under the machine. Fig. 7 is a plan and end view of the machine, and Fig. 8 shows the cam which moves the cutting tool, and the gear by which this cam is driven.

On the inner end of the main driving shaft is a slotted arm, to which a wrist-pin is fitted, so that it can give to the bent pitman *a* a stroke of any desired length. The outer end of this pitman is connected and gives an oscillating motion to a sleeve, at the other end of which is the pawl which engages with the ratchet-wheel *b*, this ratchet-wheel being on the outer end of the worm shaft, by which an intermittent motion is imparted to the worm-wheel and the vertical work-spindle.

There is also on the main driving shaft a miter wheel *c*, which engaging with a similar wheel, drives a transverse shaft, at the other end of which is a spur pinion which drives the wheel shown at the right of Fig. 8. A very small portion of this last mentioned wheel shows in the photograph, and on the face of it is secured the cam, Fig. 8. Across the face of this cam passes the lever *d*, which is pivoted at the right, and at the left is attached to a small stud which acts as a wrist-pin and is adjustably held in the T-slot of the arm *e*. A stud projecting from the inner side of the lever *d* engages with the groove in the cam and from it derives the motion which gives the rocking motion to the arm *e*. This arm is on the end of a shaft which at the other end carries a small pinion which engages with a rack cut on the slide that carries the cutting-tool holder, and this is thus given the required reciprocating motion. The cutter slide is adjustable to any desired angle about a stud which is concentric with the shaft referred to, and it may thus be set

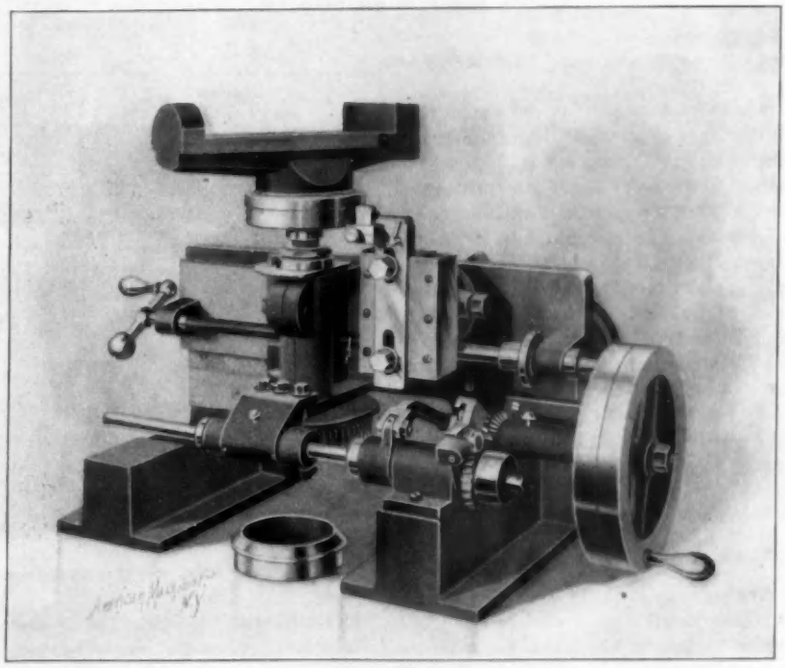


FIG. 6. GRADUATING MACHINE.

to operate upon cylindrical or conical surfaces according as the slide is set vertically, as shown in the photograph, or to the required angle as indicated by the graduations at *f*.

The depth of the lines is regulated by the surface of the work itself by means of the bearing points seen in Fig 7, and the tool is pressed to the work by a spring. It is obvious that the machine may be made to cut either upon the upward or the downward stroke, as may be desired, and a dial with adjustable pointer that turns with the work-spindle indicates the points on the work at which the graduations are to begin and end.

It will be noticed that the upper point of the cam, Fig. 8, is higher than the others, and this therefore gives a greater motion to the lever *d* and the cutting tool, thus making every fifth line longer than the others. The pinion which drives the gear and cam has, of course, just one-fifth as many teeth as the gear, so that the work is indexed for each movement of the tool derived from the cam. In securing a worm-wheel with sufficient accuracy for this purpose, the previously described testing machine was very useful, and as this worm has practically nothing to do except to move the work-spindle against its own frictional resistance, it is expected to remain accurate for a long time.

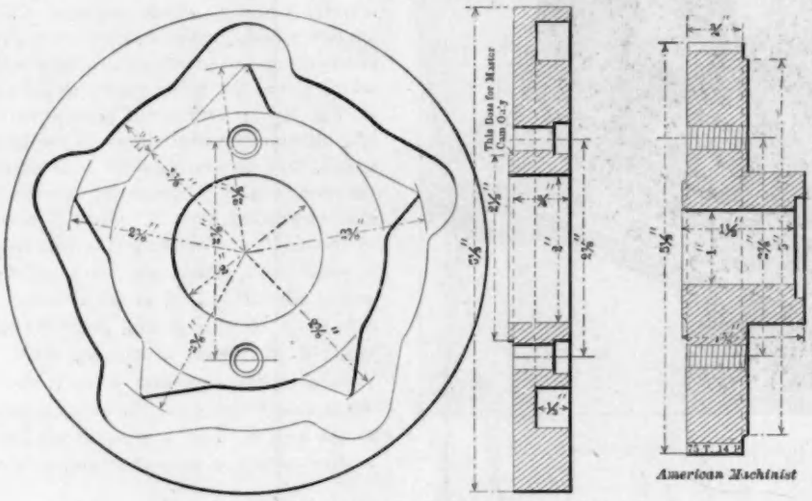


FIG. 8. CAM AND GEAR FOR GRADUATING MACHINE.

MACHINE FOR MARKING FIGURES.

Graduations such as are made by the last described machine are always accompanied by figures which indicate what they mean. The usual way of putting these figures on is to stamp them on after the graduations have been made. Such a course would ruin a finely graduated circle such as is used on astronomical or engineering instruments. Such circles must have practically nothing done to them that may disturb them in any way subsequent to the operation of graduating. The figures on such work are usually cut in by hand with a graver, and it is preferable to do this before the graduating is done. Hand-graver work would not do for the figures on a milling machine for obvious reasons; but in the shops of the Cincinnati Milling Machine Company the figuring of the circles is done before the graduating by means of the machine which is shown in Figs. 9 and 10. Here the work is mounted on a vertical spindle and rotated by means of the bevel gear seen below and a cone-pulley not visible. By means of the two similar spur gears seen above in Fig. 9, a die which is mounted on a stud fixed in a movable saddle, is made to rotate with the work, and as the saddle is forced up to the work by the hand-wheel seen at the other end of the machine, the figure-dies, which are inserted in the manner shown in Fig. 11, are pressed into the work, and the job is thus neatly and quickly done; all the figures are sure to be of the same depth (about 0.008 inch), as indicated by a dial on the screw which moves the saddle and no mistakes can occur—every figure is sure to be in its exact proper place and in perfect alignment with all the others. The work is, in short, readily perceived to be far superior to even the best and most carefully done hand work.

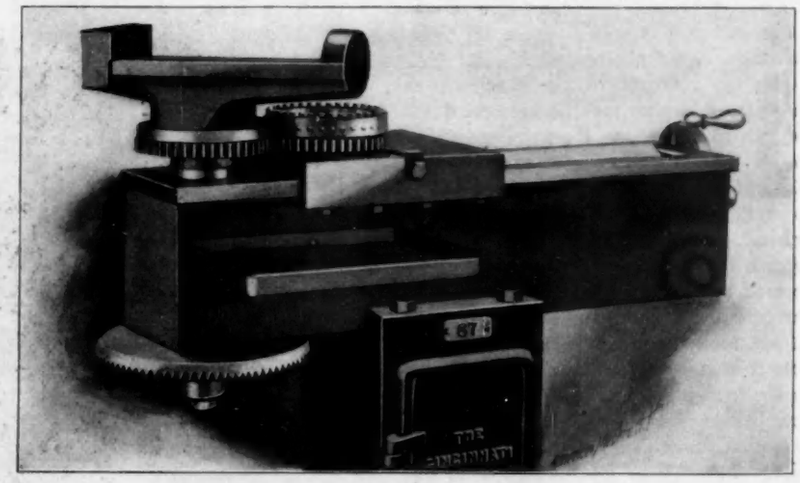


FIG. 9. MACHINE FOR MARKING FIGURES FOR GRADUATIONS.

Fig. 10 shows the machine with the saddle for figuring conical surfaces, and Fig. 12 shows the die used for these.

It will be recognized, I think, that these points of practice as found in this shop speak volumes for the systematic and orderly manner in which the work is carried on there, and the careful thought which is bestowed upon it. These are only a few ideas added to the many we have previously published, and for which I feel that the craft is greatly indebted to the liberal-minded policy which controls the establishment referred to. F. J. M.

The Latest and Largest Hydraulic Press.

The largest hydraulic press now in the world is said to be that one recently completed at the Parkhead Forge, England. This press has been three years in construction and erection and is capable of a pressure of 12,000 tons. It is used in the manufacture of armor plate. The cylinder for the press is 72 inches diameter. It is of nickel steel, the weight of the casting being 65 tons and the finished weight 42 tons. The width of the frame inside the columns is 15 feet, and the working hight under the crossbeam is 13 feet. The power is supplied by four sets of coupled compound condensing engines, with cylinders 21 inches and 43 inches and 18 feet stroke. This steam pressure actuates sixty-eight pumping rams, each 1 11-16 inches diameter, which deliver the water to the main cylinder of the press. To lift the press-face, crossbeam and ram, two return cylinders of 15 inches diameter are fitted, working at an accumulative pressure of 1,300 pounds per square inch. The foundation of the press is composed of 1,125 tons of brickwork and a bed of concrete weighing 330 tons.

Kipling in the Engine Room of a British Warship.

"Isn't it scandalous? Isn't it perfectly damnable?" said an officer after we had got under way, pointing to the foul, greasy columns of smoke that poured from every funnel. "Her Majesty's Channel Squadron, if you please, under steam, burning horse-dung."

Truthfully, it was a sickening sight. We could have been seen thirty miles off, a curtain of cloud, spangled and speckled with bits of burning rubbish and lumps of muck. The first lieutenant looked at the beach of clinkers piling up on his hammock nettings and blessed the principality of Wales. The chief engineer merely said, "You never know your luck in the navy," put on his most ancient kit, and was no more seen in the likeness of a Christian man. Fate had hit him hard, for, just as his fires were at their pink of perfection, a battleship chose to get up her anchor by hand, delaying us an hour and blackening the well-cherished furnaces. "No. 2 Welsh" (this must have been an Admiralty jest) needs a lot of coaxing.

But we were not quite such an exhibition as the Arrogant. She showed like a chemical works in full blast as we swept out of Bantry and headed south for the Scillies. Then up came the Blake, a beautiful ship, giving easily to the swell that was lifting us already, and she dodged about left and right till we asked: "What are you trying to do?"

"Trying to get out of your smoke," said she, vomiting cascades of her own the while. Meantime the fleet rams were doing their best to blind and poison us, and the battleships sagged away to leeward looking like wet ricks ablaze. It was not the ignominy of the thing—the mere dirt and filth—that annoyed one so much as the thought that there was no power, in the state which owes its existence to the navy, whereby a decent supply of state-owned, state-dug coal could be assured to us. There had been a strike, and while masters and men were arglebargling ashore, Her Majesty's ships were masquerading in the guise of chimney-sweeps on the high seas. The delay, the disorder, the cruel extra work on stokers, not to mention the engineers, who at all times are worked pitilessly, is, in peace, no more than merely brutal. In war it would be dangerous.

FIG. 10. MACHINE FOR MARKING FIGURES FOR GRADUATIONS.

As if that were not enough, the swell that the battleships recorded in their logs as "light" (Heaven forgive them!) began to heave our starboard screw out of the water. We raced and we raced and we raced, dizzily, thunderously, paralytically, hysterically, vibrating all down one side. It was, of course, in our four hours of full speed that the sea most delighted to lift us up on one finger and watch us kick. From 6 to 10 P. M. one screw twizzled for the most part in the circumambient, and the chief engineer—with coal-dust and oil driven under his skin—volunteered the information that life in his department was gay. He would have left a white mark on the assistant engineer, whose work lay in the stokehold among a gang of new Irish stokers. Never but once have I been down in our engine room, and I do not wish to go again till I can take with me their designer for four hours at full speed. The place is a little cramped and close, as you might say. A steel guard, designed to protect men from a certain toothed wheel round the shaft, shore through its bolts and sat down, very much as a mudguard sits down on a bicycle wheel. But the wheel it sat on was also

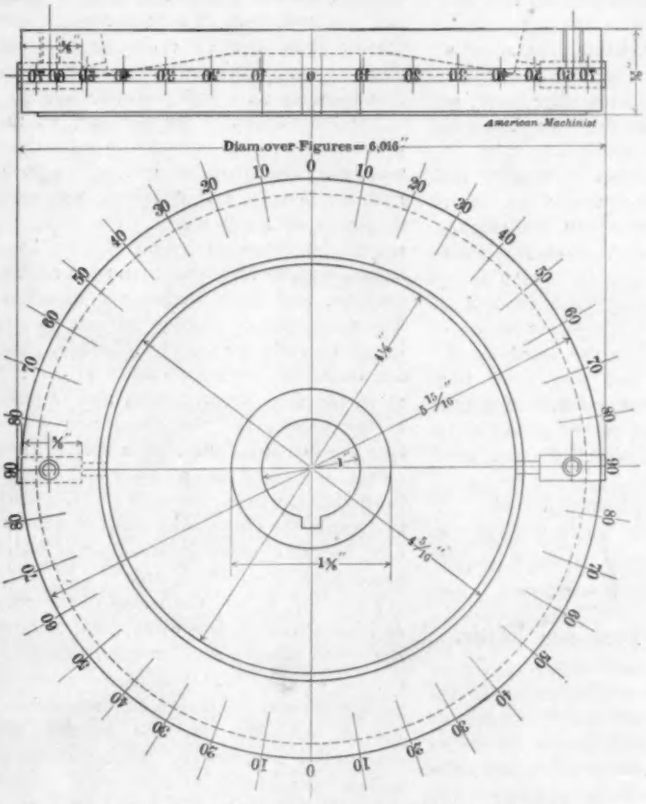


FIG. 11. DIE FOR MARKING BODY FOR NO. 1 SWIVEL VISE.

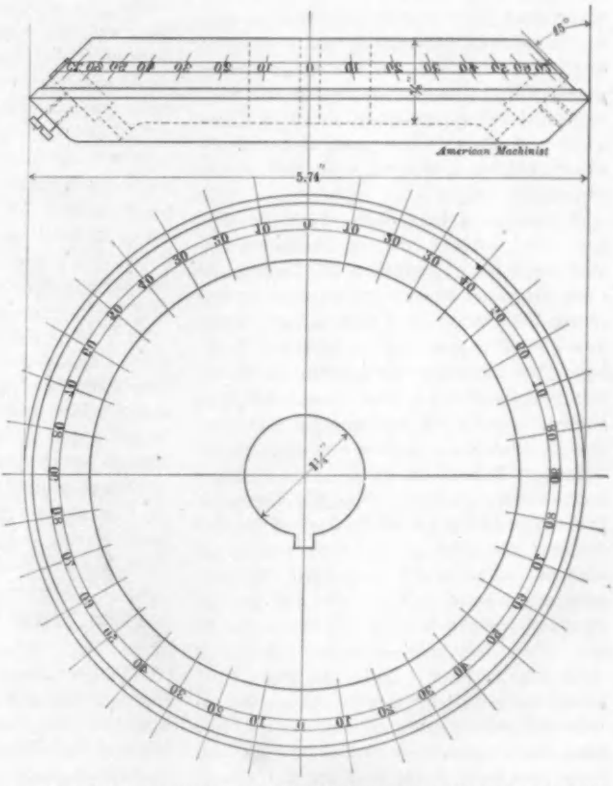


FIG. 12. DIE FOR MARKING DIAL ON COLUMN FOR GRINDING MACHINE.

of steel, spinning 190 revolutions per minute. So there were fireworks, beautiful but embarrassing, of incandescent steel sparks, surrounding the assistant engineer as with an aurora borealis. They turned the hose on the display, and at last knocked the guard sideways, and it fell down somewhere under the shaft, so that they were at liberty to devote their attention to the starboard thrust-block which was a trifle loose. Indeed, they had been trying to wedge the latter when the fireworks began—all up their backs. The thing that consoled them was the thought that they had not slowed down one single turn.

"She's a giddy little thing," said the chief engineer. "Come down and have a look."

I declined in suitable language. Some day, when I know more, I will write about the engine rooms and stokers' accommodations—the manners and customs of naval engineers and their artifices. They are an amazing breed, these quiet, rather pale men, in whose hands lie the strength and power of the ship.

"Just think what they've got to stand up to," says Twenty-one, with the beautiful justice of youth. "Of course they're trained at Keyham and all that, but fancy doing your work with an 8-inch steam pipe in the nape of your neck, an' a dynamo buzzin' up your back, an' the whole blessed shoot whizzin' round in the pit of your stomach! Then we jump about an' curse if they don't give us enough steam. I swear, I think they're no end good men in the engine room!"

If you doubt this, descend by the slippery steel ladders into the bluish copper-smelling haze of hurrying mechanism, all crowded under the protective deck; crawl along the greasy foot-plates, and stand your back against the lengthwise bulkhead that separates the desperately whirling twin engines. Wait under the low-browed supporting columns till the roar and the quiver has soaked into every nerve of you, till your knees loosen and your heart begins to pump. Feel the floors lift below you to the jar and batter of the defrauded propeller as it draws out of its element. Try now to read the dizzying gage-needles or find a meaning in the rumbled signals from the bridge. Creep into the stokehold—a boiler blistering either ear as you stoop—and taste what tinned air is like for a while. Face the intolerable white glare of the opened furnace doors; get into a bunker and see how they pass coal along and up and down; stand for five minutes with slice and "devil" to such labor as the stoker endures for four hours.

The gentleman with the little velvet slip between the gold rings on his sleeve does his unnoticed work among these things. If anything goes wrong, if he overlooks a subordinate's error, he will not be wigged by the Admiral, in God's open air. The bill will be presented to him down here, under the 2-inch steel deck, by the power he has failed to control. He will be peeled, flayed, blinded or boiled. That is his hourly risk. His duty ships him from one ship to another, to good, smooth and accessible engines, to vicious ones with a long record of deviltry, to lying engines that cannot do their work, to impostors with mysterious heart-breaking weaknesses, to new and untried gear fresh from the contractor's hands, to boilers that will not make steam, to reducing valves that will not reduce, and auxiliary engines for distilling or lighting, that often give more trouble than the main concern. He must shift his methods for each, and project himself into the soul of each; humoring, adjusting, bullying, coaxing; refraining, risking, and daring, as need arises. Behind him is his own honor and reputation—the honor of his ship and her imperious demands, for there is no excuse in the navy. If he fails in any one particular, he severs just one nerve of the ship's life. If he fails in all, the ship dies—a prisoner to the set of the sea—a gift to the nearest enemy. And, as I have seen him, he is infinitely patient, resourceful and unhurried. However, it might have been in the old days when men clung obstinately to sticks and strings and cloths, the newer generation, bred to pole-masts, know that he is the king pin of their system. Our assistant engineer had been with the engines from the beginning, and one night he told me their story, utterly unconscious that there was anything out of the way in the noble little tale.

It was his business so to arrange that no single demand from the bridge should go unfulfilled for more than five seconds. To that ideal he toiled unsparingly with his chief—a black sweating demon in his working hours, and a quiet student of professional papers in his scanty leisure.

"An' they come into the ward room," says Twenty-one, "and you know they have been having a young hell of a time down below, but they never growl at us or get stuffy or anything. No end good men, I swear they are."

"Thank you, Twenty-one," I said. "I'll let that stand for the whole navy if you don't mind."—Rudyard Kipling in the New York "World."

How Metal Wheels are Made.

BY B. F. SPALDING.

When we think of machinery it pictures itself in shining surfaces, as though a large proportion of the machines in the world were of high finish, like watches and some marine engines. It is not correct. The greater portion of the work which is done in the world by machinery is done by rough machines. Much of this class of machinery is portable, goes on wheels, on the ground. Not much comment does it get in the journals which are the vehicles of mechanical intelligence; but its progress merits occasional notice.

A change has taken place in the last few years in the material of which many wheels are made. It was wood; it is now steel. This change was noted and commented upon in the "American Machinist" six years ago, and since then, notwithstanding the bad times, the business has grown rapidly. It has probably increased threefold. As the utility and availability of metal wheels become more widely known the demand for them increases. While this new business is scarcely heard of in the East, large manufactories, equipped with the most advanced tools and methods, have been established in the West, and annually consume for their product thousands of tons of steel. The strength, durability and cheapness of metal wheels have made the manufacture of some machines profitable which would not have been on the market if these wheels had not been available. The wheels are made in commercial quantities for a great variety of machines, baling presses, binder master wheels, binder grain wheels, corn and other planting machines, corn shellers, cultivators, farm trucks, grain drills, hay rakes, tedders and loaders, horse-powers, plows, portable engines, road graders, thresher separators, wheelbarrows. A drawback to the profitableness of the manufacture would appear to be this great variety; for every different kind of wheel is a separate article of manufacture. Every variety also requires a change of some kind in the manufacturing, and every change takes time and costs money.

The dimensions of the tire vary all the way from 15 inches in width to 1¼ inches, with thickness from ¾ inch to ⅛ inch, each width with any thickness, and each thickness with any width. The tires are not all flat; some variations of form have names, such as half-oval, channeled, ribbed, concave, and some shapes are nameless. The possibility of cutting any tire to any length extends the variety infinitely. And the variations are not so much in the tire as in the size, shape, length and number of the spokes, and the manner in which they are fastened; and also in the different forms, sizes and complications of design in the hubs, which, formerly satisfied with two parts, the spoke-shell and the spindle-box, are now more involved since roller bearings have come into use.

From hub to tire the wheel is the prey of innovation. It is always liable to have some new thing put on it anywhere, even outside of the tire. The motor wheel of an agricultural machine must turn around, for if it slides on the ground the mechanism is inactive. Therefore these wheels are provided with spurs which settle into the ground and prevent sliding. These spurs are attached to the tire and are of many forms and are attached in many different ways. In a single metal wheel manufactory there are made no less than 1,500 different styles of wheels.

The principal form of corn planter wheel tire was for some time that shown in Fig. 1. It was 5 inches wide and from ⅛ inch to ¼ inch thick. The concave

was ⅜ inch deep. Not more than a dozen years ago I took a day on purpose to see them welded under a trip hammer. They were heated by a hard coal furnace under the narrow cap which projected over the slotted top, through which the flames were driven on to the tire. It was a good arrangement for the time, but the tires are welded four or five times as fast now by the use of the later improvements.

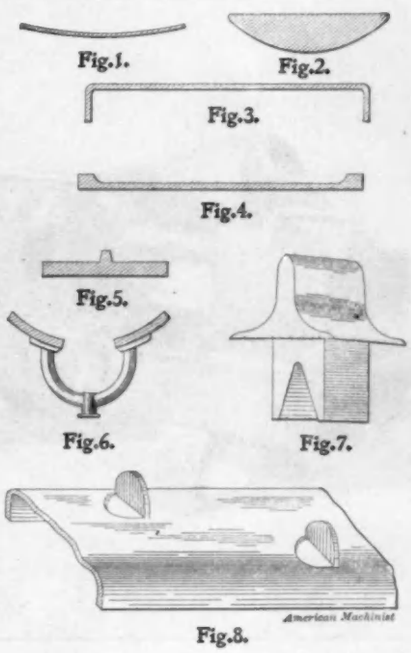
A binder master-wheel tire had a cross section like Fig. 3. It was 9 inches wide after bending the flanges down 1⅜ inches, and was 3-16 inch thick. Another binder main-wheel tire is shown in Fig. 4. It is 9 inches wide, 3-16 inch thick in the middle, and the sides are 7-16 inch thick. The wheel is about 3½ feet in diameter. A favorite form of cultivator tire is half oval, as in Fig. 2, 1¼ inches wide and 5-16 inch thick in the center. When they were made by hand it was more convenient for welding to have them of flat cross section, but when they are welded in dies the shape of the cross section is of little consequence, as the dies can be made to weld one form as well as another.

Many corn planter wheels are now made with double tires and open centers. Fig. 6 shows the cross section of the two tires riveted to the fork which is riveted to the spoke. They are 2 inches x ¼ inch, and some 800 is a day's work at welding them as flat tire 30 inches in diameter. They must be well united, for when they are cold they are put in the dies of a hydraulic tire shrinker and the six jaws close around them with a forty bear-power hug, and in some fraction of a minute one edge of the tire has been contracted so that one side of the tire is an inch and a half less in diameter than the other. That side of the bar has been contracted nearly five inches.

One would suppose such an expenditure of force would produce quite sensible heat, but when it is felt for with the bare hand there is found so little heat that it requires faith to perceive that there is any. Nor is any heat developed in the machine, although the operation is repeated every two minutes, as it compresses 300 a day. This is not a case for comparison between machine work and hand work. Such work is not done by hand, and no comparison can be instituted. If machinery was not available these wheels would not be made. These tires, which have to be compressed after welding, are not punched until after they are compressed. All other tires are punched as the first operation upon them.

The multiple punch displays its advantages by punching all the holes in some tires at one stroke. There are eight holes in a cultivator tire, and it punches 1,200 tires a day. The tire shown in Fig. 3 has twenty holes, there being two rows of spokes with ten spokes in each row. These holes are punched on a common punch press, the dies of which, however, are so made that they punch four holes at a stroke, and with this arrangement upwards of 150 tires are punched daily.

When one machine does a lot of work, a lot of work stops when it stops. For instance: Once there was a multiple punch punching five holes ⅝ inch diameter through steel ⅝ inch thick. Now, it is easy to vary the length of the punches a little, so that the whole strain may not come at once, but it was not thought that the punch needed humoring, although the shear strain was about equal to punching a hole 3 inches diameter. There had been foul work on the punch before, and there was known to be a slight crack in one of the uprights. This time there came a bar which was as hard as though it had been



DETAILS OF METAL WHEELS FOR AGRICULTURAL WORK.

hardened. It was the time to decide the question whether the machine would stall or break, and the balance wheel did not stop to give the question any consideration. There was quite a loud report; no very great disorder. The upright simply let go and the upper part raised up enough to permit the revolution of the eccentric, and the machine was thoughtfully thrown out of gear. The balance wheel came to rest after a while, and when the new upright came and was set up, no one would know anything had ever happened except for the pile of work that was behindhand to prove that a machine that can do much work can stay much work.

Perhaps nothing can give a better idea of the amount of time that is void of visible product than the output of some machine which makes regular strokes, and makes a piece at every stroke if the work is fed to it. Of this kind are the bolt machines, used for making the collar-head end of the spoke which is to be riveted in the tire. They can head a spoke at every stroke and run 36,000 strokes a day, and 17,000 spokes a day is the best day's work that has been done on one, although when everything is in good running order every stroke is easily caught. The fuel is gas, and the fire constant and uniform, and a pair of well hardened dies of good steel will last half a day without changing. Open hearth steel is used for spokes exclusively, after years of experiment, as its uniformity can be depended upon.

One successful process of making metal wheels is the preparation of the tire by punching the spoke-holes and bending. The malleable-iron hubs have their spoke-holes cleared out by drilling or drifting. The spokes having been forged are then riveted into the hubs hot, with a machine that throws out a collar outside of the hub at the same time that it rams up a head in a recess on the inside. These machines head several thousand spokes in the hubs in a day, from six to twenty spokes in a hub. The rims or tires are then put on, and the spokes are riveted in them cold, by riveting machines. They then pass into the adjuster's hands, who takes the kinks out of them so that the lap of the tire fits for the welder. They are heated on a gas furnace for welding. It has three fires attached to a central standard, around which they are revolved as wanted. When a tire is at a welding heat, the fire is holding it where it can be conveniently lifted out and dropped on the die of the welding hammer. The spark-shields are instantly in place, and the quick-running hammer makes the weld, while the operator moves the tire to receive the blows to the best advantage. The wheel is then handed to the trimmer, while the welder places another tire in the furnace and swings it away, bringing the tire that is hot up into its place. Some of the light tires are welded at the rate of two in a minute, and some, on wheels that weigh 375 pounds each, require as much as five minutes to a weld. The trimmer trims off any fins that may have raised, and trues up around the weld. The spindle boxes are very forcibly set in the hubs after the tires are welded. The hubs being thus reinforced are prevented from being cracked by the strain. A general inspection and truing up follows and completes the process.

The spurs are sometimes pieces of malleable iron which are put on the outside of the tire, from one spoke to another, diagonally across on a double-spoked binder wheel. The ends of the spokes pass through and rivet the spurs on with the tire. Setting them askew is supposed to prevent the wheel from sliding sidewise on a side hill. Some malleables are made that form a rib around the center and spurs at each side. Some tires have the rib rolled on, as shown in Fig. 5. It is 4 inches wide and ½ inch thick. On narrow wheels a form of spur is used, shown in Fig. 7. The shoulder is about 1½ inches

square, and the spur an inch high. The split shank is easily riveted into holes punched for the purpose between spokes and spaced about 5 inches apart. A 30-inch wheel with tire 3½x3-16 had lugs punched free on three sides and bent up as shown in Fig. 8.

Three traction engines recently sent to Cuba had driving wheels built of steel plate by the manufacturers of the engines. They weighed 3½ tons each, or the pair to each engine weighed 7 tons. They were 8 feet in diameter, 2 feet face. Each had thirty-six lugs, 4 inches wide, 1¼ inches thick, riveted diagonally on the tire and extending the full width of the wheel. Contrary to general practice, the space occupied by the lugs was greater than the space between them, which would indicate that they were designed as much to protect the ½-inch steel tire as to improve the traction. The front wheels also were built up of steel plate. They were 5 feet in diameter, 15 inches face. The weight of each engine is 25 tons. They are to be used for transporting sugar-cane. The wheels on the wagons they are to draw on the public roads are 6 feet diameter, 12 inches face; hub 12 inches long; double row of spokes cast into hub and bolted to tire; spokes, 3x½-inch steel. A few of these traction engines rolling along the paths of industrial progress would have a weighty influence in settling that commotional isle.

The National Tube Works Company, of Pittsburgh, has been awarded a contract for ten miles of 28-inch pipe for the Rand gold mines of South Africa. The order aggregates a million dollars in value.

Shafting Machinery.

As probably most of our readers know, the lathe as a means of manufacturing shafting, where this is done on a large scale, has been almost superseded, but comparatively few have seen the machines by which this has been done. We take it, therefore, that the machines illustrated herewith will prove of interest, as they are, so far as we know, the latest development along this line. The first of these, Fig. 1, is the machine which does the turning, and rough round bars of iron or steel are passed into this machine and come out at the other end roughed and finish turned, much the same as boards go into and out of a planing machine. The machine consists essentially of a large hollow shaft supported in large bearings, and having at each end of this shaft a head which may be likened to an immense hollow mill or box tool. In conjunction with these are feed rolls which feed the bars through without rotating them.

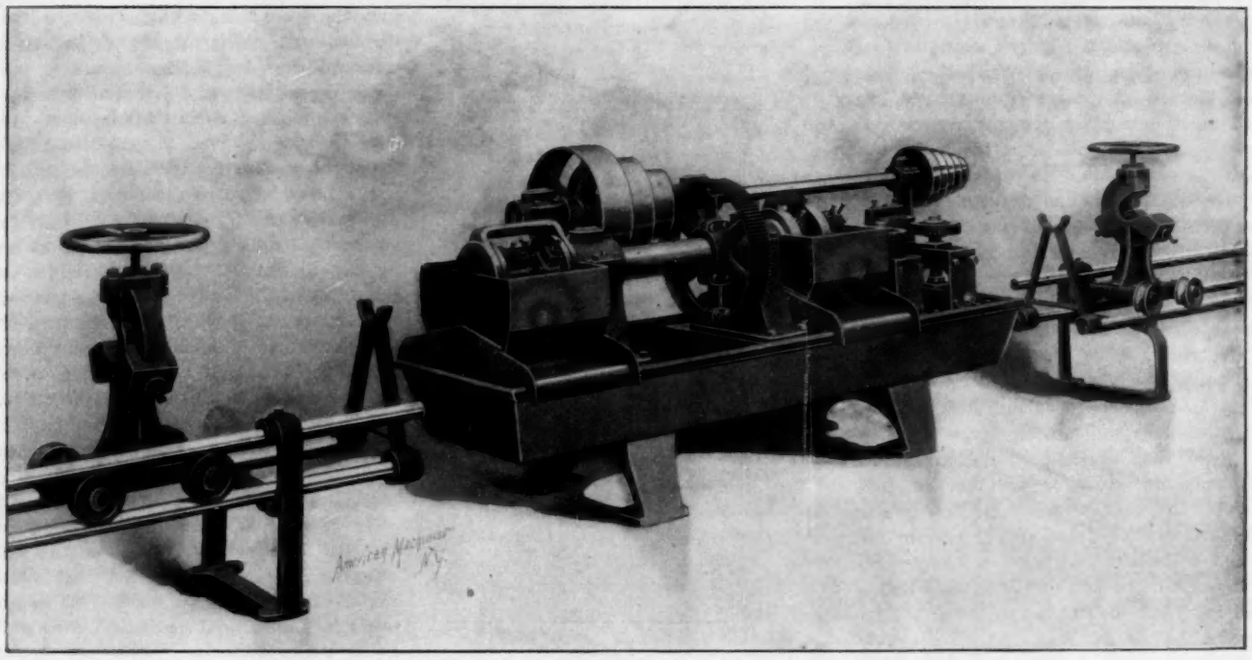


FIG. 1. SHAFT-TURNING MACHINE.

The method of driving the cutting spindle is clearly indicated in the photograph, and at the right-hand end of the machine are the feed rolls, two of which appear on vertical shafts. There are four of these feed rolls which can be adjusted to or from the material, and in the center of the group of four thus formed is a stationary guide which is provided with a bushing that approximately fits the material. A feed cone having five steps imparts motion to the feed rolls through the medium of worm gearing.

The bar to be milled is first clamped in the traveling rest shown at the extreme right, which is free to roll upon the bars supporting it, and is prevented from being tipped over by the upper bar seen at the rear. The hand-wheel being tightened upon the material, it is thus prevented from rotating, and upon being pushed forward between the feed rolls, which are held in contact by powerful springs, it is pushed through the rest and through the roughing head. This removes the bulk of the material, and the shaft then passes through the hollow spindle to the finishing head at the other end, which removes a light cut; and when it has protruded a sufficient distance from this end of the machine, it is clamped in the similar traveling rest seen at the left, which, however, when the photograph was taken, was turned round with its rear side toward the observer. An abundance of soda water is used on the cutters, and this flows to the base of the machine, which is made to retain it, and is again pumped on to the cutters by a pump at the rear of the machine, but which does not appear in the engraving. As shown in the drawing Fig. 2, only one cutter is used in each head, there being in conjunction with it three rests, all of these being adjustable by screws, as shown. With this machine it is practicable to turn from 1,200 to 1,500 feet per day of 2-inch shafting, other sizes from 1 to 6 inches diameter being turned in proportionate amounts. The chips are retained in the casing shown around the heads, which are so constructed that they may be readily cleaned out while the machine is in operation, the inclined surface upon which they rest being perforated to allow the lubricant to pass through into the bed of the machine.

The second machine, Fig. 3, is for straightening and smoothing. It has the same traveling carriages placed on either

side of it, and the bars or tubes which have been previously turned to size are passed through its hollow spindle and between the hard smooth rollers having concave surfaces, as shown. These rollers are adjusted to press heavily upon the material, and as they revolve their contact with it smooths the surface, covers up any slight superficial imperfections there may be and straightens it on the principle of the well-known wire straightener, this latter function resulting from the position of the first four rollers, which it will be noticed alternate with each other from opposite sides. On each head carrying a roller there is a rest through which the shaft passes and is thus retained in its central position. The last pair of rolls are placed opposite each other and give to the shaft its final burnishing. The speed of rotation is varied in accordance with the size and character of the material to be operated upon, and the rolls may be adjusted to any desired angle, as well as radially and lengthwise.

At Fig. 4 is shown the final machine of the series. This consists of a press, the upper and lower portions of which are connected by heavy tie rods, and at the top is a heavy cam shaft driven by the belt fly-wheel and gearing shown. This cam shaft works in a bronze bushing which passes through the head, which is

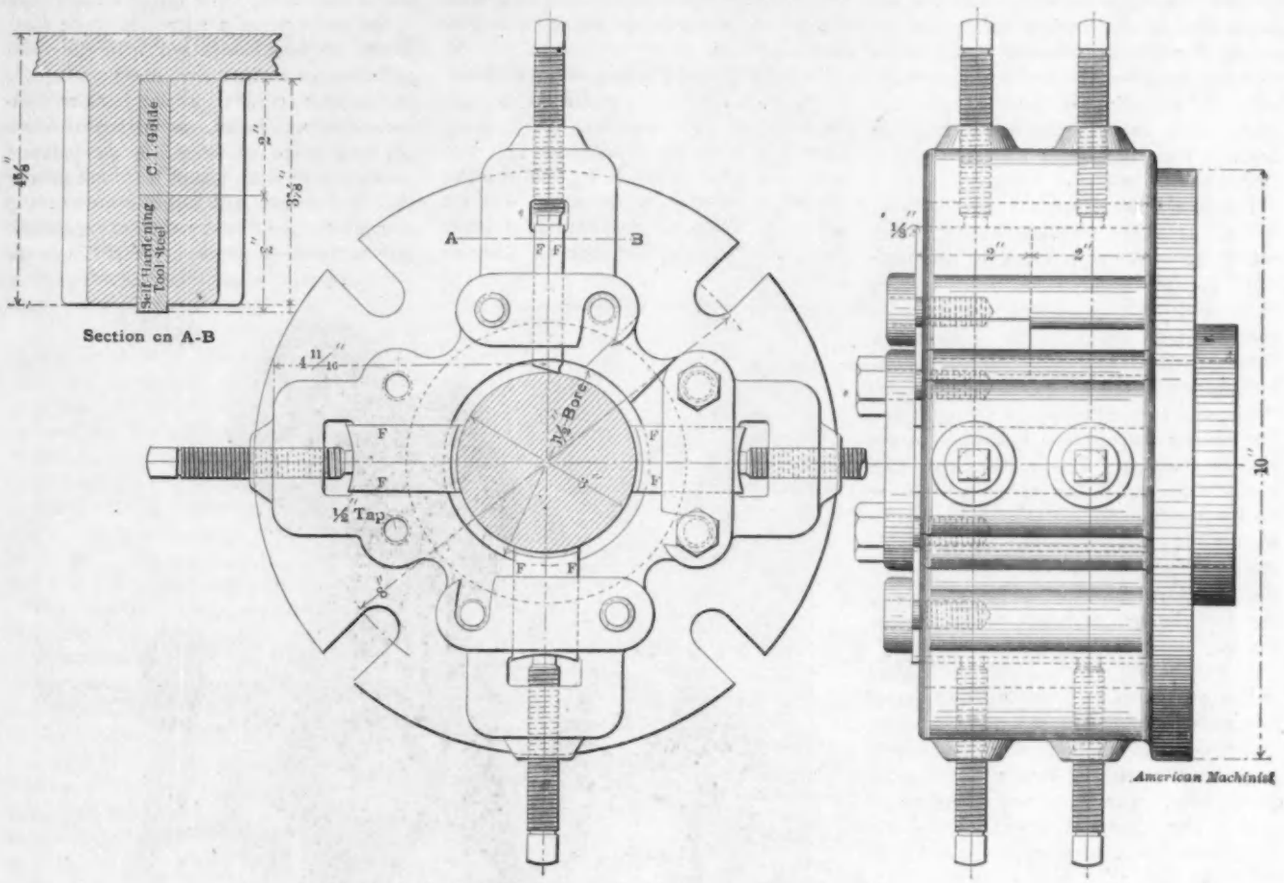


FIG. 2. HOLLOW MILL OR BOX-TOOL FOR TURNING SHAFTING.

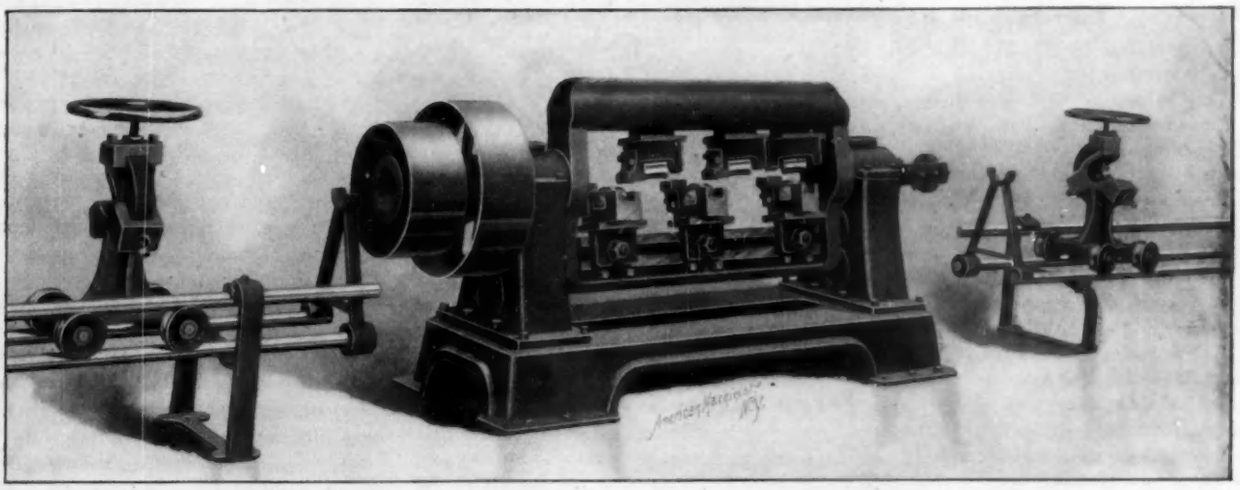


FIG. 3. SHAFT STRAIGHTENING AND BURNISHING MACHINE.

thus given a short vertical reciprocating movement. Below it is another sliding head, which is held in its highest position normally by two stiff springs. In the center of this head is a screw, which is adjusted by the workman to suit the requirements of the work in hand, and by means of a foot treadle the wedge is introduced between the top of this screw and the reciprocating head above, this wedge thus causing the lower head to descend with the upper one to any required point.

The rolls upon which the shaft rests at either side of the machine revolve it and enable the workman to chalk or otherwise mark any crooks or bends there may be in it, and by then merely applying his hand to hold the shaft it is prevented from rotating and the high spot is brought under the plunger to be straightened. Suitable adjustments are provided for making the machine adaptable to any size of shafting. This machine is often used chiefly as a tester of the work done by the machine shown in Fig 3; that is to say, it shows whether the shaft is really straight or not after coming from the straightener, and if not quite straight, the facilities are at hand for straightening it.

It will be noticed that by this process shafting requires no centering, and unless unusually crooked no preliminary straightening is required, and when finished it answers all ordinary requirements as to smoothness, roundness and accuracy of size. The machines are built by the Brightman Manufacturing Company, Millersburg, Ohio.

Success in Coke Making—and other Business.

The following by Fred. C. Keighly, in the "American Manufacturer," would seem to be just as applicable to, and just as true of many other lines of business as coke making—the machine business, for instance—and it requires no effort to read or to understand it:

"This chapter is written for the special benefit of the young man who has made up his mind to be a coke maker—perhaps a coke king—for there are men in the coke business who are kings in their line.

"I have said young man, for the reason that it is pretty hard to make coke makers out of old men; and there is no truer saying than the old proverb, 'it is hard to teach old dogs new tricks,' though some people think differently; but if they could have a little of the experience that I have had in that line, they would want that old proverb in letters a foot high, nailed right over the office door.

"A young man cannot learn to make coke by wearing a 'biled' shirt, white collar, kid gloves and patent leather shoes at the coke works. But if he gets right down to hard pan in the beginning, and 'catches the bull by the horns,' even though he does make mistakes (and he will make lots of them), he will learn to make coke at the proper figure, and in time that will undoubtedly bring him the 'biled' shirt and all the rest of the paraphernalia of a prosperous business man, to which he will be justly entitled.

"Get all the knowledge you possibly can, young man, but do not undertake to make coke out of your knowledge, for good, clean coal is far better fitted for that purpose, and when it comes to coke making, all the knowledge in the world will not weigh as much as one pound of good, clean coal. It is true that an ignorant man will not make the best coke man, but it is a fact that a man who is intelligent enough to realize his ignorance of the little details of the coke business, will learn to make coke sooner, and will make a better man than the one who is so inflated with knowledge that he cannot see his own feet.

"If you go to the most skillful physician or surgeon of the age, he will tell you that unless his patent gets careful nursing, all his knowledge and skill are useless in the case.

"The young coke maker, and, perhaps, some older ones, can learn a lesson from the above fact. They will find that careful nursing of the plant they have in charge will be of more real value to them than all the books on coke ovens and coke making in existence, not even excepting the article in hand.

"If the young coke maker will take the trouble to study the career of some of the coke men of the Connellsville coke region, who have made a mark for themselves, he will find that vigorous action, and not knowledge, is the most valuable ingredient in the make-up of a successful coke man. There are men connected with the Connellsville coke business to-day who are just as great generals in their line as General Grant was in his, and perhaps if some of them could be placed in the balance, their relative merit would be found greater than that which has brought fame to many a man in other lines; yet in every case it will be found that these successful men are not what might be classed as students or scientific men, but they are men of incessant activity and force.

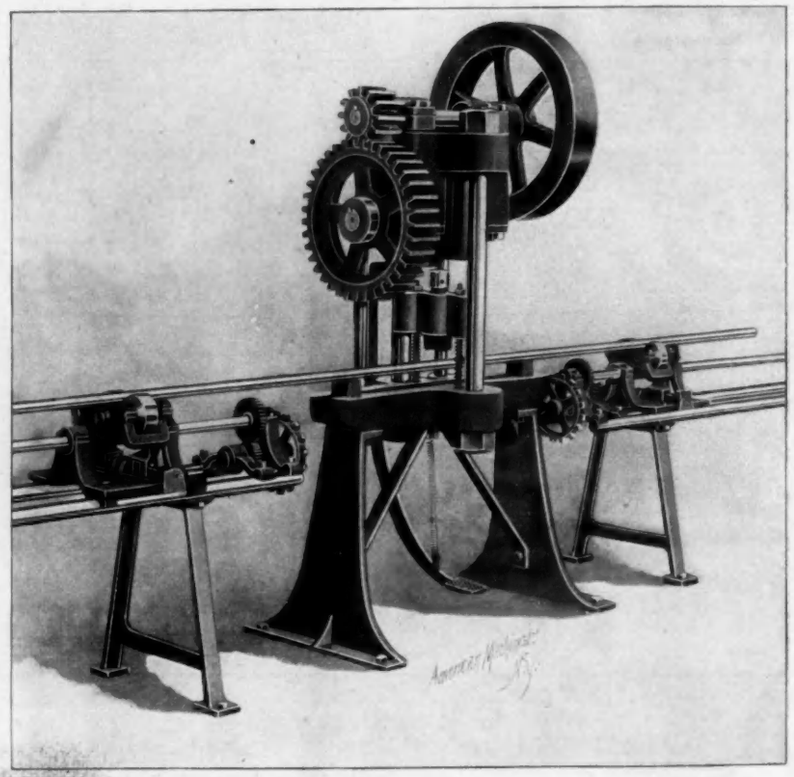


FIG. 4. SHAFT STRAIGHTENING PRESS.

"If I were to express an opinion as to what contributed most towards the building up of the reputation of the most prominent and successful coke manufacturer of to-day, I would unhesitatingly state that it was executive ability, which is only another form of action.

"Many people think that knowledge of the business is the prime requisite; but that it not true, for there are men drawing coke to-day who know more about coke making than many a manager, but they have not the ability to apply their knowledge.

"A certain coke manufacturer once remarked, 'When I want a superintendent I do not want a mining engineer; when I

want a mining engineer I do not want a superintendent.'

" 'In other words, I want a man who is master of his business, not a jack of all trades.' "

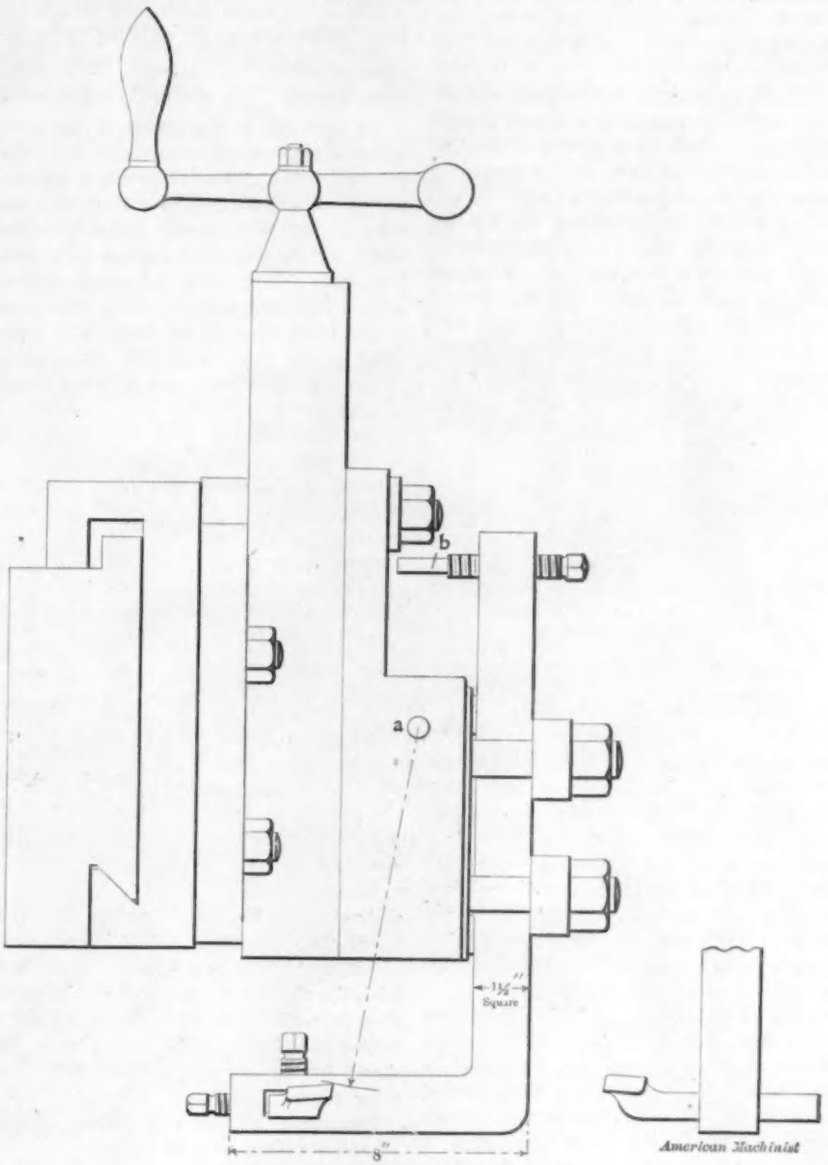
An Undercut Planing Tool Holder.

The accompanying sketch—for which we are indebted to the F. E. Reed Company, of Worcester, Mass.—shows a method for overcoming the difficulties of planing the under side of a flange or other projecting piece and relieving the tool on the back stroke of the planer which is new to us. It is of the simplest possible construction and works to perfection, as we can testify from personal observation.

The tool holder is a simple bent piece of square steel, very much like the holders used for key-seating the hubs of pulleys or gears, but bolted to the clapper in the reverse way from a key-seating tool holder —that is, running under the tool box instead of projecting in front of it—the tool, however, facing forward in the ordinary way. The length of the bent arm is such as to carry the point of the tool well to the rear of the pin *a* on which the clapper swings. In consequence of this location of the tool, its first movement on lifting the clapper is downward—that is, away from the work. This action will be understood from the short circular arc and radius line drawn for the cutting point of the tool. It will thus be seen that during the reverse motion of the planer the clapper lifts as usual and the tool relieves itself as freely as in ordinary work, although the movement of the tool is the reverse of that due to the ordinary setting. At the same time, and more neatly still, the weight of the upright arm of the holder, assisted by the weight of the clapper, is greater than that portion of the horizontal arm of the holder to the left of the swing pin, so that at the end of the back stroke the clapper falls in place and the tool rises to its cutting position without outside help. In fact, the action of the tool is as free and as devoid of annoyance or danger as in ordinary planing. The partial side view will assist in showing how the tool is carried to project it under a flange and reach the work to be done.

There is one precaution to be observed, growing out of the fact that after the point of the tool has reached the perpendicular through the clapper pin, any further movement will cause it to rise, when it would be very apt to catch and make trouble. Such excessive swing might arise from a very free swinging action or from the tool rubbing against the vertical portion of the work on the return stroke of the machine. To make this impossible an adjustable stop *b* is put through the upper end of the tool bar and is so adjusted as to strike the flat surface of the tool box before the tool has reached the danger point, and so prevent further motion.

The sketch and the dimensions given are from a holder in regular use in the Reed works in planing the under sides of the upper flanges of lathe beds for attaching the rack and for the carriage gibs to engage with. The action of the tool at first sight is decidedly odd—rising to position as it does by the force of gravity, and by the same movement that ordinarily causes it to fall to position, and a moment's thought may be necessary before the reader grasps the idea.



AN UNDERCUT PLANING TOOL HOLDER.

In England recently, to make room for a new building, it became necessary to move a large iron tank laterally 131 feet. The tank was 82 feet in diameter and 32 feet high, weighing 140 tons, its flat bottom being only a few inches above the ground level. A wall 2 feet high was built enclosing both the old and the new foundations, the space being filled with water, when the tank was floated and easily hauled to the new position. The draft of the tank when afloat was a little over 8 inches, and the actual removal occupied only a few minutes.

The Failure of the Steam Engine.

A man undertakes in a Boston paper to show which is the coming motor for road vehicles. He says it is air, and if anyone doubts that he knows, let them read how he disposes of steam:

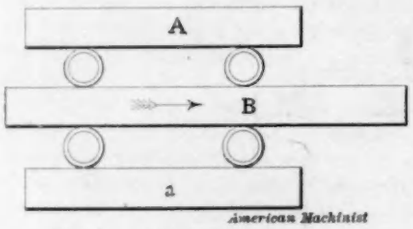
"If the water runs low or the *air pump* does not work, or the *cylinder rings fail to expand*, then your steam carriage is not a success."

Sterling Elliott sends us the clipping and says: "I only regret that these things are not as funny to the average reader as they are to mechanics. It occurred to me that this man's criticism of the steam engine might interest the readers of the "American Machinist," all of whom are more or less familiar with the terrible results which are likely to follow 'should the cylinder rings fail to expand.' "

Franklin Institute Tests of the Hyatt Roller Bearing.

Our readers, who are all familiar with the Hyatt roller bearing, will be interested in a report of a test recently conducted by a sub-committee of the Franklin Institute for the purpose of ascertaining its comparative efficiency. The committee by whom the tests were conducted was composed of James Christie, Hugo Bilgram, Spencer Fullerton, J. Sellers Bancroft and H. W. Spangler.

The Hyatt roller, it will be remembered, is not solid, but resembles a closely wound spiral spring made from a strip of steel of flat rectangular section, and is therefore easily flexible longitudinally, while in rotundity also it is not absolutely rigid under the pressure to which it is subjected in working. It was asserted that one of the principal causes of failure on the part of anti-friction rollers, accurately made and well mounted, is due to an unequal distribution of pressure on the face of the rollers, causing distortion in detail or gradual destruction of the rollers. The inequality



TESTING THE ROLLERS.

of pressure may be due to slight deflections of shafts, or to the yielding of supporting surfaces, or the axes of rollers and shafts may not be exactly parallel. The endurance and frictional resistances of rollers under varying conditions of dimensions, material and speed were not considered in the present tests, the only question being as to the relative merits of the solid and the spiral-formed roller.

Four of the Hyatt spiral rollers and four solid steel rollers, all uniformly ¾ inch diameter and 10 inches long, were used in the tests. The Hyatt rollers were formed of strips of steel ½ inch wide and ⅛ inch thick, the steel being harder than that of which the solid rollers were made. This harder material rendered the Hyatt roller less liable to abrasion, but it was considered to have no effect upon the resistance to rolling so long as no abrasion occurred. The rollers were placed as shown in the sketch, known pressures being applied upon plate *A* by a testing machine, and a measured horizontal force applied to the center plate *B*. The faces of plates *A* and *a* were planed, and in one series of the experiments both faces of *B* also, while in the other series both faces of *B* were left just as they came from the rolling mill. Increasing pressures were applied up to a maximum of 550 pounds per lineal inch of roller. The apparatus employed would not permit a higher pressure on account of the resistance of plate *B* with the solid rollers, although with the spiral rollers a pressure of 700 pounds was practicable. Instead of the unyielding screw pressure of the machine, a weight and lever were also employed to apply the pressure, with no appreciable difference in the results. The weight and lever experiment gave the following:

Total Pressure Applied.	Resistance of Plate B. Spiral Rollers.	Solid Rollers.
2,000 pounds.	9 pounds.	26 pounds.
3,000 pounds.	17 pounds.	34 pounds.

An appendix to the report of the committee embraces tables compiled from the records of the extensive series of experiments. The resistance to motion was less with the spiral than with the solid roller under all the pressures applied, and with both the smooth and the rough center plate. The reduction of rolling resistance varied from 10 to 66 per cent., and averaged 51 per cent. less with the smooth plate, and 23 per cent. less with the rough plate.

The thoroughness of bearing contact between plates and rollers was also examined. With the rough center plate the incomplete bearing of the solid roller was plainly discernible, and under the maximum pressures the solid roller showed indications of grooving, the usual manner of failure of anti-friction rollers. The spiral rollers showed a complete bearing throughout their entire length. The pressures employed in the experiments were about as high as good practice tolerates with the slowest motion, and much higher than is permissible with the velocities of ordinary shafting. The following is deduced by the committee from Table 1 of their report.

Percentage of coefs. of rolling friction of spiral rollers to solid rollers:

Plates Planed.

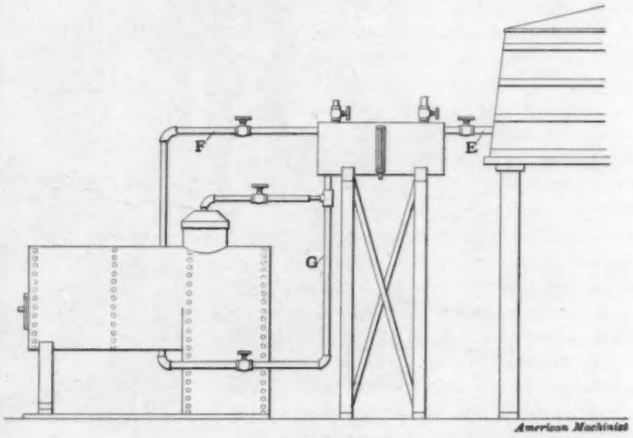
Least	34 per cent.
Greatest	67 per cent.
Average	48.7 per cent.

Plates Rough.

Least	60 per cent.
Greatest	90 per cent.
Average	77 per cent.

A Practical Gravity Boiler Feed.

In connection with the recent discussion in our columns based upon the query "Can we feed a boiler for nothing?" the arrangement shown in the sketch has been brought to our notice, and is said to have been in successful operation for two years. There is a tank, at a level sufficiently above the boiler level to ensure the flow of the water by gravity, and an intermediate vessel, called the feeder, with the pipes and valves practically as shown. The feeder has a gage glass on the side. The directions are, assuming first that all valves are closed, to open valve *E* and fill the feeder nearly full, as shown by the glass. Then close *E* and open *F* on the steam pipe. When the simmering sound, caused by the contact of the steam with the water, ceases, the valve on the feed pipe *G* is opened and the water flows by gravity into the boiler. The steam pipe and feed pipe are then closed, when valve *E* may be again opened, and so on as often as necessary. The feeder should be protected as much as possible from heat radiation, and no other source of loss appears. The water is heated to the full boiler temperature before entering the boiler, and the feeder is therefore considered a water purifier also, much of the precipitation occurring in the feeder



PRACTICAL GRAVITY BOILER FEEDER.

which would otherwise take place in the boiler. There is a flexible joint in the pipe within the tank, the end of the pipe being carried by a float to draw the water from near the surface instead of from the bottom. The water in the tank may be heated by a coil through which the exhaust circulates, without coming in contact with the water. The apparatus is made by the Gravity Boiler Feeder Company, Little Rock, Ark.

An interesting example of what the copyist can do is shown by an instance which occurred in connection with the profiling machine shown elsewhere in this issue. A copyist undertook to build such a machine, and when he had it finished bragged that his machine was better than the Pratt & Whitney machine because they made their cross-rail in two parts connected together by bolts, while he had made his solid, and it was therefore much stiffer. It is said that when someone told him why it was made in two parts he made a saw-cut through his own machine and introduced the bolt for adjustment.

Improved Profiling Machine.

The machine of which we give herewith an illustration is an improved form of a tool which, although long known in shops where certain kinds of work are done, is practically unknown in the regular shops, though in many cases it might be advantageous if it were better known in them. It is designed, however, primarily for manufacturing operations, and is known as a profiling machine. On sewing-machine work, small-arms manufacture and work of that character, it is practically indispensable.

Mounted on the front extended bed of the machine is a platen which is moved in one direction by the crank handle seen at the left, the other end of this shaft having a spur gear which engages with a rack on the under side of the platen. This provides for the movement of the platen in one direction, while the saddle carrying the two vertical spindles seen above is moved in a direction at right angles to the platen movement by means of the crank handle shown at the right; this being connected (by the spur gears and pinion shown) to a rack attached to the saddle and lying underneath the cross-rail at the right. Both these racks are made in two parts and arranged so that by suitable adjusting screws all back-lash or lost motion can be taken up; which is especially important in the operation of this machine.

The spindles, which are driven by quarter-twist belts from the drum shown at the rear of the machine, carry milling cutters of suitable size and shape, and the work to be milled is usually held in a suitable fixture, attached to which, or in some cases attached to the platen independently, is a form or templet which is of the shape desired to produce upon the work. This form is produced in various ways, but in the machine shown provision is made for making it in the machine itself.

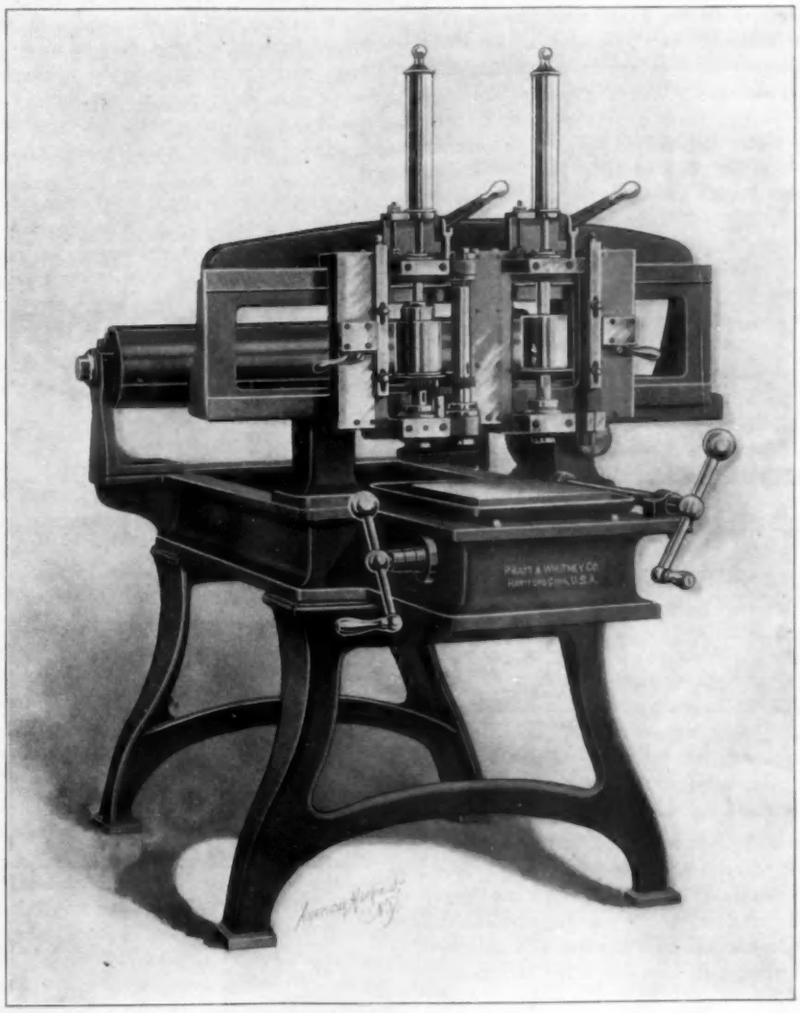
Between the two main spindles an auxiliary or supplementary spindle will be noticed. This, in the ordinary operation of the machine, does not rotate, but holds a tapered plug or pin which bears upon the edge of the former, and thus controls the relative position or movements of the platen and saddle to reproduce the outline; but when a form is to be made, the model of the work is fastened to the platen, a guide-pin is inserted in the main spindle at the left and a milling cutter in the supplementary spindle. Gears are then engaged, so that this supplementary spindle is rotated and mills the form or templet, reproducing the contour of the work. This templet can then be left in position on the machine, the milling cutter removed from the supplementary spindle, the former plug inserted in its place, and the work can proceed.

It will be understood that the motions of the saddle and platen are controlled by the hands of the operator, who has only to keep the guide-pin against the templet, and, this pin being tapered, and the spindle which holds it being provided with independent vertical adjustment, provision is thus made for variation in size of milling cutters due to grinding or other causes. Helical springs inclosed in the cylindrical cases seen at the top return the spindles to their topmost position when released, and adjustable check-nuts limit the motion of the slides at the top and bottom.

On each side will be noticed a rectangular bar having slots and provided with about an inch of vertical adjustment. When the fixture has been made so that the proper position for it is known, a notch is cut in this bar in which, when the spindle is brought down to its proper depth, a square spring-bolt engages and holds it at that hight until released by the small lever seen below the casing for the bolt. This lever being depressed allows the counterbalancing spring to raise the spindle.

An interesting feature of the machine is in the means for maintaining a straight surface on the upper face of the cross-rail. Immediately behind the saddles and on top of the cross-rail will be noticed a beam, which in the photograph looks as though it might be a part of the cross-rail. It is a separate piece, however, and rests upon the cross-rail at each end only, while in the center is a bolt which passes up through the upper portion of the cross-rail and taps into this beam, so that, by tightening the bolt, wear which takes place in the center of the cross-rail can be compensated for by slightly springing the latter until the surface is again practically straight.

The machine is made either as shown, with two spindles, or with one spindle and with or without the attachment referred to for milling the templets, known as the Parkhurst device, by the Pratt & Whitney Company, Hartford, Conn.



IMPROVED TWO-SPINDLE PROFILING MACHINE.

There is a marked improvement in the iron and steel trade in Sweden. The steelmakers are highly satisfied with the position of the market. Already they have large orders on their books from Sheffield at remunerative rates, and negotiations for others are proceeding, the higher prices asked meeting no serious resistance, as in any case the advance here is moderate compared with the figures ruling on the English market.

Letters from Practical Men.

Drawing Hexagon Nuts.

Editor American Machinist:

A large part of every professional man's work is routine, or the doing repeatedly of what is familiar, and which requires little skill. For such work there come to be established ways of doing it, and facilities which hasten its accomplishment are accumulated. This is perhaps more true of the draftsman than of most others, and where an amateur attempts the work of the professional he often makes a poorer competitive showing with the routine work, and the comparatively easy work, than with the more difficult and really responsible part. The amateur must waste lots of time in determining proper angles and suitable tapers, and the

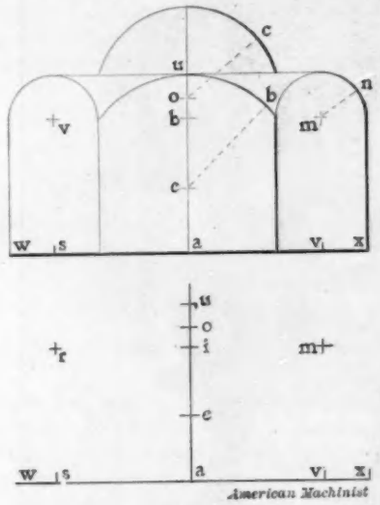


Fig. 2

DRAWING HEXAGON NUTS.

relative proportions of parts, and then must devise processes for their correct representation upon the board, and waste a lot of time, while the professional and fully equipped man has no such processes to go through and can turn off the work rapidly.

I occasionally have to do a little drawing of something more or less in the mechanical line, and I generally get disgusted over the time it takes me to do the simple things, and many of them go undone, such as drawing the correct curves for screw threads and such things, and the links of chains and the twists of ropes and the teeth of gears; you find very little of these things in my collected works. I can't dodge entirely the drawing of hexagon nuts and bolt heads, and that I have got down to something like system, and I now turn them off at pretty good speed. I show here my way of doing it, so that if possible, someone will show me a better way, and also as a starter for some of those more amateurish amateurs than myself, who have not yet got any way at all.

Fig. 1 shows a hexagon nut and the projecting end of the stud or bolt, as I draw it. It looks to me about like those which most draftsmen make. The end of the bolt is not made a full half-circle, but is struck from a point below the top of the nut, which, I think, looks more natural and better, but anyone may use the top of the nut for the center if he wants to, and, of course, it is cheaper to do so. In drawing these nuts, we of course, have to start with the center line of the bolt and the base line of the nut, and from the point *a* where these lines meet as a center I strike with the compasses the successive points *e, i, o, u, w, x, s, v.* Of these, *a u, a w* and *a x* are made with the same setting of the dividers, as also are *a i, a s* and *a v*.

These settings of the dividers are taken from the diagram, Fig. 3. The diagram is supposed to have vertical lines 1-16 inch apart all across, but I only draw enough at the left to show. There are many diagrams of this character that it comes in the way of the draftsman and others to make, and instead of the cross-section paper, which is now common enough, it would be a great convenience if we had also paper ruled with equidistant parallel lines in one direction only. Take the diameter of the bolt on the base line of the diagram, and on the perpendicular which rises from that point all the various spacings will be found where the oblique lines cut the perpendicular. The dimension indicated by each oblique line is indicated at the left of the diagram. Thus Fig. 1 has been drawn by the use of this diagram, and it shows a nut for a 1-inch bolt. The dimensions were taken from the 1-inch vertical line of the diagram. The measure from the base line to the upper oblique line gave *a—u, a—w* and *a—y*. From the base to the second oblique line down, the dimension *a—o* was obtained, and from the third line *a—i, a—s* and *a—v*, and so on. The centers *r* and *m* were located by the square and triangle from the marks on the center line and base. Where, as usually happens, there are several nuts to be drawn on a common base-line, one set of n arks is of course enough for all the vertical dimensions. With the points located as in Fig. 2, it is a simple matter to describe the arcs and the straight lines which complete the figure.

This is one of the operations which take more time to describe than to do. The diagram is really much better than nothing, although there may be some system much better; and if so, doubtless many readers of the "American Machinist" would be glad to know it.

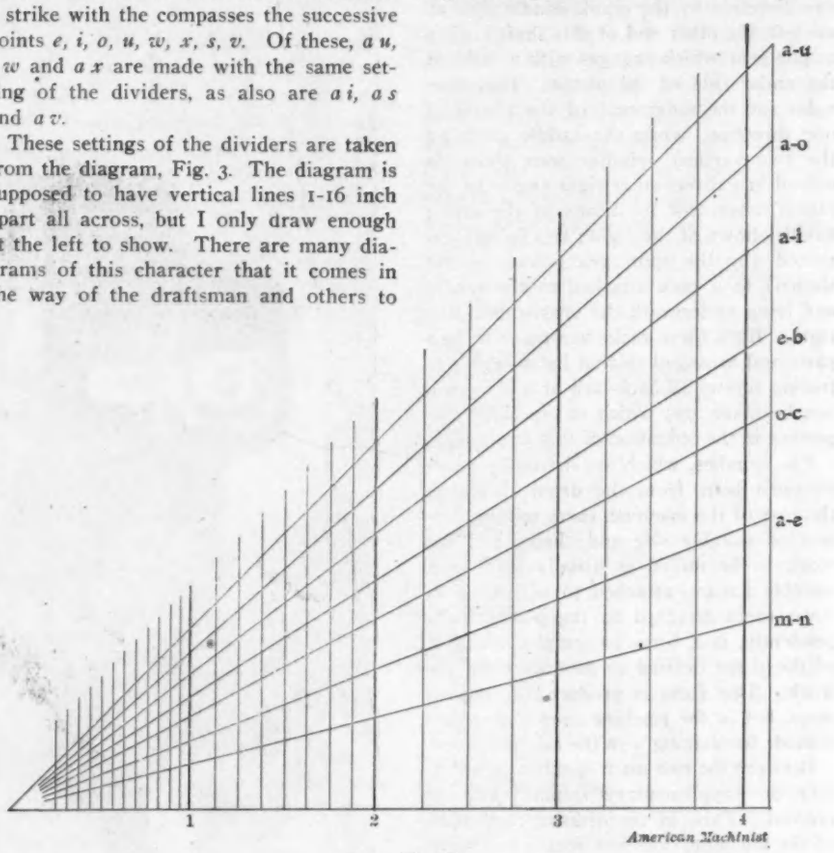


Fig. 3

SCALE FOR DRAWING HEXAGON NUTS.

MORRIS FULTON.

Philadelphia.

The Problem of Power Storage—A Little Book Experience.

Editor American Machinist:

For the various service of modern man much mechanical power is required, and the quantity imperatively demanded is a constantly increasing one *per capita*. They talk of the consumption of sulphuric acid as the measure of the civilization of a people, and other things have been suggested for the same purpose, but perhaps no better test could be found than the

horse-power test. If we could only get the horse-power of all the steam engines and water wheels and windmills and other motors that are working for us, the total would no doubt be highly creditable to us. It would take several horse-power to run myself and my little family, and I am not at the top of civilization, either.

Of the various means of power generation, or, rather, of power conversion, in connection with its transmission to the precise spot where it can be most advantageously applied, and often to the spot where only it can be employed, all seem to lie more or less, and some very completely, under the objection that the power must be used immediately as it is furnished or not at all, while our uses of power and our needs of power are nearly all necessarily intermittent, so that the problem of power storage is really to-day of as great and pressing importance as are either that of power generation, power transmission or the actual means by which the power is finally applied; and at the same time the problem is a more perplexing one, and has less promise of satisfactory solution than any other.

This lack of ability to store power is an inconvenience and a loss at both ends of the service. In direct electrical transmission, for instance, whatever is driven is stopped instantly with the stoppage of the generator, whether it be lights or street cars or the machines of a factory, and entirely without regard for the necessity of uninterrupted service. Here some means of power storage, so that it may be instantly available when the source of power temporarily fails, is an evident necessity. Something, of course, is done to help the matter by the storage battery, and with compressed air there is always a limited supply in the receiver; but the storage of the power for even a short time is costly and inconvenient, and it is impracticable for extended periods.

But the greater demand for means of extensive power storage is where the power is first developed. We have enormous water powers which at the best cannot be one-half availed of, because we are unable to save and store the power. The stream flows on with equal force forever; the mill, or whatever it may be, we cannot run, say, more than half the time; yet all the same, the water that has passed while the mill is stopped can never thereafter be made to do the grinding.

Then, the storage of power for conveyance to unlimited distances is also much to be desired. The transmission of electrical energy, for distances up to fifty miles or so, has made many water-powers available, usually for a part only of the twenty-four hours; but the ideal means of power storage should be independent of both time and distance. The power, or the temporary embodiment of it, should be capable of conveyance anywhere, and the power, or the power effect, should be instantly available. The lump of coal gives the best known example of power storage for long time with the fullest possibilities of conveyance before its reconversion. The coal, as we all know, was produced by the operation of physical force and heat and light ages ago, and we have become more or less expert in its reconversion at any time and place that suits us. In the case of the coal the preliminary operation of the power storage and conveyance is accomplished for us, and all we can do is to reconvert it. We cannot make coal, but we can unmake.

What we can both make and unmake, using up power in the first operation, and developing power, or power effects, in the latter is calcium carbide, and this calcium carbide is, I suppose, our most complete and successful accomplishment in the line of power storage and conveyance. The substance is produced in an electrical furnace, and represents the consumption of a certain amount of mechanical power. When we generate the acetylene gas from the carbide and burn the gas we get the power back again. We do not get mechanical power usually, although it should be possible to do so, but we do get light, which in these days is one of the direct results of power. The energy which disappeared in the electric furnace might have been sent directly to the lamps and used at once, and that would have been the last of it. By the carbide and acetylene arrangement, the last of it, or the production of the light, may occur at any time in the remote future, and at any spot on the earth which may suit our convenience, so that the conditions of conveyance and of storage, or of holding for a length of time, and of using anywhere, are completely met.

The storage and conveyance, of course, cost something. We do not get as much light from any given amount of acetylene gas as we could have got from the direct current and the immediate lamps, but we do get quite a respectable portion of that possible light. When we realize the vast amount of power that is now used for electric lighting, and mostly for not one-half of the twenty-four hours, we may then realize how much power it would be possible to store and convey by the use of acetylene gas.

. . . . . .

In connection with this acetylene talk I have to confess to some little disappointment in looking over the little book "Lighting by Acetylene Gas," recently noticed in the columns of the "American Machinist." Such a book should naturally be expected to tell what the author knew, or had the means of knowing, on the subject, and what the reader would be most likely to want to know. I turned to it with perfect confidence for a few particulars as to cost of the light, not in dollars and cents, but in terms of the weight of carbide used, volume of gas generated and amount of light produced. These things were painfully conspicuous by their total absence. The book tells a lot about generators and lamps, but as it does not tell me what I happen to want to know I must express my disappointment.

But I have recently had another little book experience, the experience and not the book being little, as the latter cost $5, the former being thrown in. A friend, young in mechanical knowledge, and for whom I have considerable regard, wrote to me asking for some hints about books that would give him some needed information concerning steam and kindred matters. I selected from a descriptive catalog the book referred to, and sent it to him, with a little note telling him that my purpose in sending it was rather to show him how little can be learned of such technical matters from a single book than with the hope that it could be of much value. The book illustrated the point intended better than I could have expected, for upon looking it over I was astonished to find how little there was in it. It professed to illustrate and explain every kind of steam engine, stationary, locomotive and marine. It had chapters on the mathematics of the steam engine, and the "mathematics" consisted mostly of "sums" in long division. This long division business seemed to have been used for padding, instead of the tables of circles, decimal equivalents and such things that college professors make us pay for. But the long division in this book is one of the wonders of modern book making. If the divisor was, say 10, or if it was 400,000, the division would be done by long division, and every cipher would be used every time. Some of the examples covered nearly an entire page, and there were a great many pages covered with such trash, so that I had little patience to look over the rest of the book, but as far as I could see it was consistent with the long division. Here was another case where a license would have been a proper thing. If it is proper and necessary to license an engineer, he should take out an additional license if he is going to write on engineering subjects, and the readers could afford to pay the fees.

TECUMSEH SWIFT.

Chimney or Fan?

Editor American Machinist:

In your issue of February 2 H. W. K. asks: "If fan draft for steam plants is far superior to that of a chimney, as various writers say, why does the traction company of New York City erect the big chimney?" The reason that a tall chimney will be used no doubt is that the plant is to be designed to work with such draft. It may be that the engineers consider that this is the best method. This is a question on which there is a wide difference of opinion.

There are conditions which are best met by each of the methods. For example,

if there is sufficient heat leaving the boiler to make draft, and which can be used for no other purpose, then chimney draft is of course the most economical. Should, however, an economizer be interposed, the resistance offered to the passage of the gases, and the reduced power owing to the lower temperature, would probably so cut down the chimney draft that the plant could not be operated with satisfaction; then the fan would be the proper means for accomplishing the purpose. Again, if it is desired to burn screenings or other low grade fuel, it is often necessary to resort to the fan, and it is in this connection that the fan usually gets its credit for efficiency as a draft producer. The heat necessary to make steam for driving a draft fan is much less than that required to heat a volume of gas in a chimney for the same work. Therefore, as the ability of the steam generator to absorb the heat of combustion increases, so does the opportunity for economical use of the fan increase. A. BEMENT.

Chicago, Ill.

Punch and Die Criticism—A Simple Stop for Punching Washers.

Editor American Machinist:

Mr. Painter's article on punch and die construction, contained in the issue of January 5, is very interesting, and while I endorse his methods of construction as a whole, I cannot approve of his design and proportion for all classes of work. Of course I am well aware that no one design is best for everything. The style of punch and die must be, as indeed all machine design must be, modified to suit the conditions; and the selection of design best suited to the requirements is a matter of skill and good judgment.

Speaking generally, there are three points where I would criticise Mr. Painter's design, viz.: The stop, the thickness, or rather, the thinness of the punch plate *B*, and the slenderness of punches *I*.

The stop as shown in the article mentioned is very neat and no doubt superior in many cases to the one I have to propose. But when it can be used I prefer something more simple and substantial, as being better calculated to meet the rough usage one has to figure on in punch-press work. In other words *abuse* as well as *use* has to be considered.

In my own practice, where a punch plate is used at all, I prefer to make it of nearly or quite double the thickness shown by Mr. Painter, to insure steadiness in holding the punches. I also prefer to avoid the use of punch plate entirely where possible.

In my judgment the punches *I* would be much improved by making them larger in diameter and turning them down to the required size on the ends for ¼ inch to 5-16 inch of their length. Made thus they are not liable to spring, they will hit squarely, and consequently do not "shave" or dull the die.

Mr. Painter speaks of the application of punch and die made as he describes to washers, etc. The accompanying sketch shows a form of punch and punch holder for punching a plain washer, which is quite simple and satisfactory in use, and which may readily be modified to suit many other classes of work.

Referring to Fig. 1, *A* is the shank made to fit the press; *B* is a rectangular extension to it for holding the punches; *C*, piercing punch for the hole in the washer; *D*, blanking punch for outside of washer; *K*, guide or pilot for *D*, entering the hole previously made by *C*; *E*, punch for cutting out section *a* in the strip of stock, to permit the continued use of the stop, as will be described; *G*, stop for

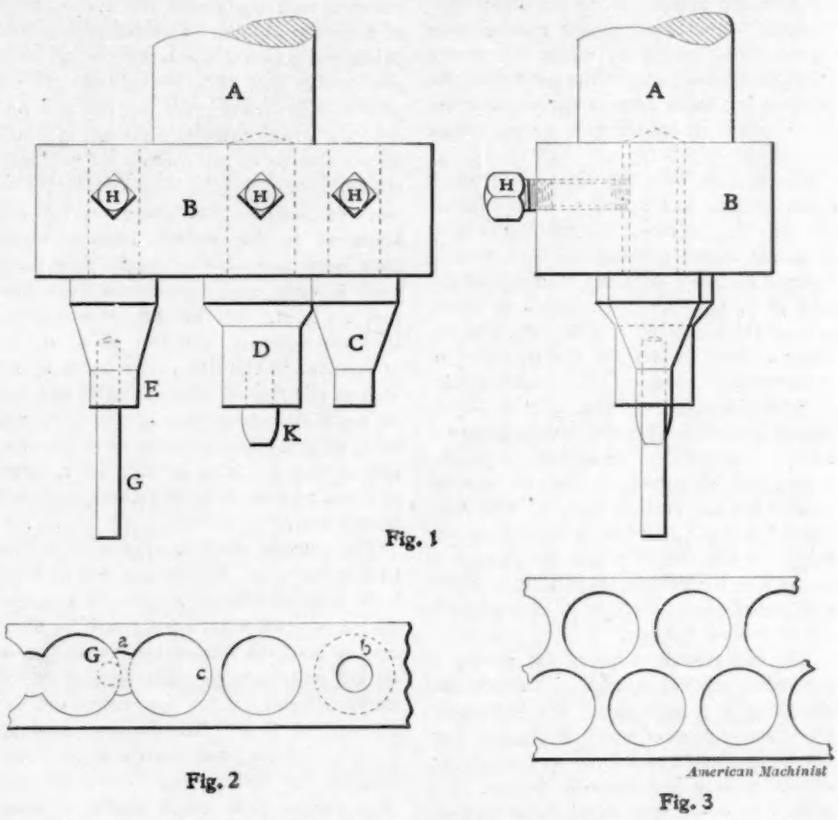


Fig. 1

Fig. 2

Fig. 3

CONTINUOUS STOP-GAGE FOR PUNCHING WASHERS.

stock, made long enough so that it does not leave the die when press is at the top of its stroke.

In Fig. 2 is shown a strip of stock, placed under the punches as it would appear after the punches have been withdrawn from the die. The strip is then slid along until point *c* strikes against stop *G*. The next stroke of the press cuts out section *a* and blanks out washer *b*, as shown by the dotted lines.

By properly arranging the stripper, or even leaving it open entirely in front, and guiding against the back edge, a wider strip of stock may be used, as shown in Fig. 3. Economy of stock is thereby secured, turning the strip around and guiding by the opposite edge after one row of holes has been punched.

In most cases of this sort a set-screw will prove the cheapest and best method of holding punches, either flat ended or pointed, entering a spot in the shank of the punch. Many have a preference for taper pins, half in punch and half in holder. This method is very good, but makes a little more work in removing the punches. B. L. CHARLES.

A Cheaper Way to Make the Piston.

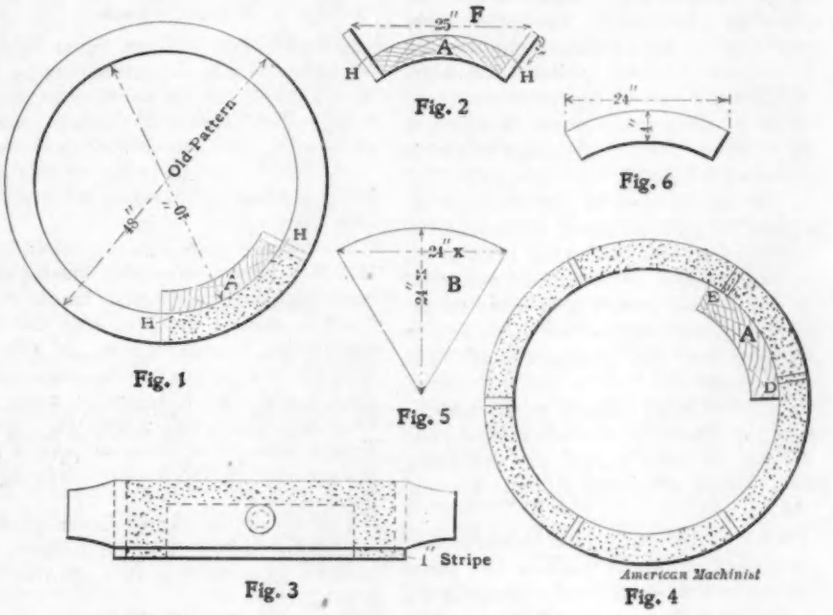
Editor American Machinist:

Seeing Mr. Williard's item in issue of February 16, I would suggest a cheaper way of making a thin 40-inch piston, using the 48-inch pattern. Reducing a pattern of this description in diameter and thickness by making two core boxes and six cores from each box is an unnecessary expense, and I think coremakers will agree with me that the six cores *B*, Fig. 5, are delicate cores to make and handle, being only 1 inch thick and 24 inches long, and consequently it would take some time to make them. The cores *A*, Fig. 6, are not very small, either, being the same length as core *B* and 4 inches wide, and would take about as much time to make as cores *B*. Then there is the expense of blacking the cores and the molder setting them in position and securing them.

Now, supposing Mr. Williard had taken

the 48-inch pattern and made a segment to the depth of what he wanted the casting to be, and of a length to exceed the radius of the large diameter (48 inches) about 1 inch, as in Fig. 2 at *F*. Make ribs *H* about 1 inch thick, fasten to segment with screws and let them extend 4 inches, the amount to be stopped off the 48-inch pattern.

Now, the casting having to be 1 inch thinner, take the drag half of the flask and put 1-inch strips on the cope side, as in Fig. 3. Put the pattern in the flask and ram up the drag half, roll it over, put on the cope and ram it up. Take off the cope, draw the pattern, take the 1-inch strip off the drag half and sweep off the sand to the face of the original flask. Place segment *A* in the mold, as in Fig. 1, the outside edges of ribs *H* coming to the



A CHEAP AND QUICK WAY OF MOLDING A SMALL PISTON WITH A LARGE PATTERN.

48-inch circle, and fill up the space between the ribs *H*. Then take out the segment and move it about one-sixth around and continue this operation until the circle is completed. When moving the segment from one space to another, place one rib in the space made by the other. When filling the last space, take off the ribs *H* and let segment rest upon body of sand, as in Fig 4 at *D* and *E*.

Then after the molder has filled up the spaces (which he will do in about one hour) he will fill up the openings made by ribs *H*.

The expense in the pattern shop would not amount to more than one hour, and the stopping off about one hour and a half, and no expense to the coremaker; not saying anything about the expense of making the core boxes.

LOUIS BADEN.

Hamilton, Ohio.

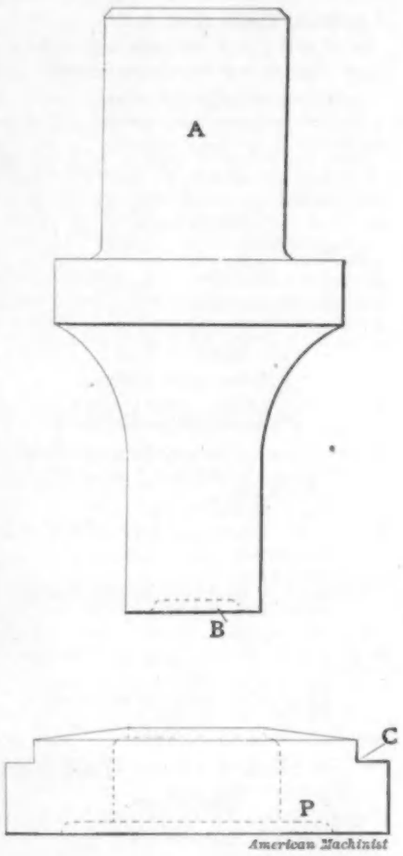
Die Making—Blanking Tools for Thin Sheet Metal.

Editor American Machinist:

As many of the earnest readers of the "American Machinist" are more or less interested in different methods of press work and die construction, I will (at the risk of over-doing the die business) send you the accompanying simple shop sketch, which I hope will aid in describing the method of making a die and punch for cutting blanks out of thin sheet metal, as steel, German silver, brass or copper.

A round blank, ¾ inch diameter, is to be cut or blanked from German silver, No. 26 metal, Brown & Sharpe gage. After they are cut, they are ready for the stamping operation, which is done in a drop press. Both the punch and die should be made from first quality of tool steel. The die is hardened and tempered, but the punch is left soft, so as it gets worn, it may be "up set" and refitted into the die, which makes it practically the same as a new punch. Referring to the sketch, the shank *A* should be made to fit the punch holder of the press (single acting), and is held in place by means of a strong set-screw. The punch is "recessed" out at the point B, as represented by the dotted lines. This is done only to facilitate the operation of grinding the cutting edge. In making the die, we "crown" it off on the top, which makes it much easier to grind after it gets dull from constant use. The die is "recessed" out at the point *P*, which leaves less to grind (after hardening) on the bottom or bearing surface, and also serves as a very convenient place to mark the number of the tools, make of steel and the date of making. It is a capital idea to especially stamp the make of the steel, as it is very useful in comparing results of different brands. The die is held in the die bed by a die-holder plate, which holds it firmly in place at the shoulder marked *C*.

In making tools for cutting thin sheet metal, the punch and die must fit accurately to produce satisfactory results. Our open-back, single-acting presses, which are adapted for blanking, etc., are either fitted with a cam-actuated, finger-motion feed or the automatic roll feed. The automatic roll feed is especially used in connection with quick-running presses.



PUNCH AND DIE FOR THIN METAL.

CHAS. C. CANDRIAN.

Springfield, Mass.

The move toward the adoption of automatic couplers on English railways seems to be gaining headway. Statistics show that in England 1,277 men were killed and 17,094 injured while engaged in making up trains during the ten years 1888-97. Last year the English Board of Trade sent a delegate to this country to study automatic couplings, this delegate reporting that such couplings had already reduced the loss of life in making up trains about one-half, while, with the universal use of these couplings, the list of dead and injured from this cause will practically disappear. The compulsory adoption of automatic couplings in Great Britain is probably only a matter of time.

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Name and address must always be given, though not necessarily published.

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The Mission of the Machinery Salesman.

We have always believed that no man can be too good a mechanic to be a salesman of machinery, and that one who is not more or less a mechanic is wofully out of his place in such business. It is doubtful even if the mechanic that is required for selling machine tools can be produced by any process of education and training alone. He must be a mechanic by birth and instinct and impulse. No amount of bragging about how excellently a machine is made, or what an amount of work it can do, really counts for much in the selling of machinery. The question in either the buying or the selling of machinery is rarely one of strength or endurance, but almost entirely that of adaptation. The machinery salesman is not, at his best, an *ex parte* pleader, but much more a judge or an arbitrator. It is fully as necessary for him to know and understand the other side as his own side. The machinery that he sells must give satisfaction, or his sales will cease. His line of machinery, or his special machine, must continue to improve, to enable it to hold its own against its alert competitors, and the salesman more than any other living man is in the position to know all the conditions under which it must work, how completely it satisfies those conditions, and what opportunities, both special and general, there are for adding to its efficiency by change in details of construction or in mode of operation. And being in the position to know these things he is also in position to communicate them, and his suggestions should be expected and should never be disregarded.

A man of high standing as a salesman in this larger sense has just passed away. We have received a number of letters from those who at different times had been associated with the late George A. Barnard, whose death was recently noted in our columns, all in high terms of appreciation and regard. In one of these letters the writer speaks of Mr. Barnard as "an exceptionally efficient salesman." The words of another correspondent, which we here quote, might be taken as an interpretation or an amplification of those quoted above.

"He was a man of the strictest integrity of purpose, most enthusiastic in his business, and thoroughly believed all he said without a thought of deception. In my opinion he has done more to advance the stationary engine to its present standing than any other one man. The greater part of his life was devoted to the sale of steam engines, giving him the best opportunity to discover the good and the bad of every engine, and permitting him to take advantage of such information."

Here is the nearly ideal salesman embodied. The improvement of the steam engine which has gone on so rapidly for a third of a century, both in its increased efficiency and its wider adaptability, but especially in the latter, and more particularly in connection with electric service and the satisfactory governing of the engine, is here sufficiently accounted for. In bringing the engine performance to its present satisfactory standard the other necessary qualification of the seller is in full evidence. The habit of insisting upon securing the best results obtainable is quite as important as that of perceiving the possibilities of the case. It has been the present writer's lot more than once to have had to look out at the salesman or traveling representative from the inside of the shop whose product he represented, and we happen to know what a benign effect the "kicker" salesman has exercised. The feeling in the shop has been that if he was satisfied there was no fear of the customer.

Whatever such men as Mr. Barnard have done for the steam engine others are doing for the various machine tools. The opportunities and the responsibilities of these latter are greater than those of the steam engine men, because the standards of performance are not so fixed and because the end of the process of development is not apparently so nearly reached.

The true salesman, then, is working in the interest of all parties, and is to be welcomed and encouraged and consulted with mutual profit. For the man whose sole function is to take orders, who has no suggestions as to how the machines are to be used and no curiosity to see them in use, on the one hand, and no suggestions as to how they are to be built and improved on the other, we have not a word, and for the firm that employs him we have little hope.

The First Air Compressor With Direct-Connected Impulse Water Wheel.

In an editorial published in our issue of November 10 last, in commenting on the description of Mr. Rix's air compressor with a direct-connected impulse water-wheel of 30 feet diameter, we gave credit to the Rand Drill Company, of this city, for originating and building the first machine of this type.

We are now in receipt of a letter from Mr. Rix, written after full investigation regarding dimensions and dates, from which it appears that the credit for this combination belongs to him. In 1880 or 1881 Mr. Rix furnished such a machine to the Spring Valley hydraulic mine, at Cherokee, Cal. The wheel was of the Knight pattern, the diameter being 8 feet and the head 150-180 feet—the exact figure being uncertain.

This is an interesting contribution to mechanical history; albeit it destroys the writer's pet belief that he originated this system.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(25) W. G., Orangeburg, N. Y., asks for a formula for computing the discharge, through orifices and into the atmosphere, of air at 10 pounds pressure per square inch. A.—The theoretical formula is as follows:

$$V = a \times 37.8 \sqrt{p \times p_1},$$

in which

V = volume of discharge per minute in cubic feet and measured at atmospheric pressure,

a = area of orifice in square inches,

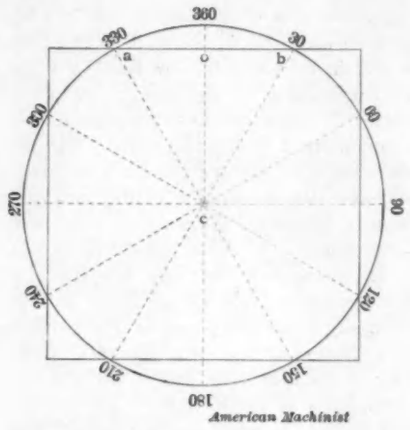
p = absolute pressure behind the orifice in pounds per square inch,

p_1 = gage pressure behind orifice in pounds per square inch.

The actual discharge will be less than that given by the formula, though it is not easy to say how much, as but few experiments to determine the value of the coefficient of

discharge have been made. For pressures of 80-90 pounds the coefficient is about .75, but we are not aware of any experiments to determine its value for the pressure which you give. The same coefficient would probably give sufficiently accurate results for most purposes. Experiments on this subject are needed.

(26) E. G. B., Lowell, Mass., asks: Are the areas equal of the circle and the square as described in the accompanying diagram, and if not, what is their comparative area? A.—This is a revival of one of the ancient attempts at "squaring the circle." If the *radius* of the circle is 1,



or its diameter 2, its area will be $2^2 \times .7854 = 3.1416$. By the construction, $a\,c\,b$ is an equilateral triangle, and the length of $a\,b$ being 1, the length of $o\,b$ will be .5. Then: $\sqrt{1^2 - .5^2} = .866$, and $.866 \times 2 = 1.732$, the distance from one side of the square to the other, or the length of one side of the square. The area of the square, therefore, is $1.732^2 = 2.9998$. As the area of the circle is 3.1416, the relative areas will be (that of the circle being 1) $2.9998 \div 3.1416 = .955$; or the area of the square is about 4½ per cent. less than that of the circle.

(27) J. M. K. L., Vancouver, B. C., asks for the rates charged for electric power in cities where it is generated from steam power. A.—In this city the flat rate is 10 cents per horse-power hour, measured at the meter. From the total per month, as determined by this rate, discounts are made as follows:

On monthly bills for 100 H. P. hours and over (less than 200), 25 per cent. discount.

On monthly bills for 200 H. P. hours and over (less than 400), 30 per cent. discount.

On monthly bills for 400 H. P. hours and over (less than 600), 35 per cent. discount.

On monthly bills for 600 H. P. hours and over (less than 800), 40 per cent. discount.

On monthly bills for 800 H. P. hours and over (less than 1,000) 45 per cent. discount.

On monthly bills for 1,000 H. P. hours and over (less than 1,500), 50 per cent. discount.

We are not acquainted with the rates charged elsewhere.

(28) "Guillermo," Elmira, N. Y., asks: How is the horse-power indicated by a prony brake to be computed? A.—A familiar arrangement of the prony brake consists of a large pulley on the engine shaft and a clamp surrounding the pulley with large rubbing surfaces. The tension of the clamp should be adjustable; and, as a part of the clamp, an arm should extend out horizontally at right angles to the engine shaft, the end of the arm being supported by the platform of a common weighing scales. The bearing point of the arm should be a knife-edge parallel with the engine shaft. The bearing point of the arm may be at the same hight as the center of the shaft, or it may be higher or lower. The distance of this bearing point from a vertical line passing through the center of the shaft should be carefully measured, and this distance is then the working radius of the brake. The weight of the arm upon the scale when hanging free should be compensated for or should be deducted from all subsequent readings of the scales. The brake being in operation, multiply its working radius by 6.2832, this product by the rotations per minute, and this, again, by the pressure of the arm upon the scales, and divide the product by 33,000; the result will be the brake horse-power. Thus, say that the length of the arm, measured as described above, is 4 feet, the rotations 150 per minute, and the pressure on the scales 90 pounds; the horse-power will be: $4 \times 6.2832 \times 150 \times 90 \div 33{,}000 = 10.28$ horse-power.

Meeting of the Junior Members of the A. S. M. E., and Narratives of the War Service of the Vulcan.

On the evening of March 7 a meeting was held at the house of the American Society of Mechanical Engineers in this city, under the direction of a committee of junior members of the society, and for the purpose of effecting an organization and perfecting arrangements for regular meetings, with the reading of papers, informal discussions and mutual information and improvement. The number in attendance was small, with probably more seniors than juniors, and little progress was made in the proposed movement. It is, however, expected that later a greater momentum will be acquired.

Those who attended the meeting were well repaid by the addresses and exhibition given by Chief Engineer Gardiner, C. Sims and Lieut. W. S. Aldrich, of the floating machine shop and supply ship Vulcan. Capt. Sims' address did not go into shop details, but dwelt entirely with war experiences at Santiago, and later with the attempt to tow to Northern waters the raised Spanish ship Maria Theresa. His detailed and thrilling account of the taking off of the crew from the unmanageable and apparently foundering ship was one of remarkable heroism and endurance, and must have satisfied all who heard it of the absolute necessity of the abandonment and of the desperate conditions under which it was accomplished, without the loss of a life.

Lieut. Aldrich's address was entirely shoppy. He gave a detailed account of the ship as a shop, with the arrangement of the tools and the routine of shop operations. The most interesting and novel feature of the installation, after all, seemed to have been in the foundry equipment, which was very thoroughly tried and found of incalculable value in supplying necessary parts to the ships, and without which they could not have kept in efficient service. Interesting samples were shown of the range of work done. Both addresses were copiously illustrated by lantern slides, and the entertainment was protracted with satisfaction to all until a late hour.

Deficient Incrustation.

Everything industrial in Germany, as is well known, is carefully inspected and supervised by the authorities, but the education of these gentlemen is not always up to the average of that of their fellow-countrymen, as the following story shows. The other day a Government official inspected an iron foundry, and remarked in his report to his superior that there was no incrustation in the boilers at the works. Upon which the superior, in evident disgust at what he considered a want of enterprise on the iron founder's part, at once issued the peremptory order: "The deficient incrustation of the boilers at this factory is to be remedied forthwith."—"Practical Engineer."

Personal.

Mr. P. H. Horan, for the past seventeen years with the Pratt & Whitney Company, Hartford, Conn., has made an engagement with the E. W. Bliss Company, Brooklyn, N. Y.

Mr. J. G. Lepper, who for four years past has been chief draftsman and designer of the Wheeler & Wilson Manufacturing Company, Bridgeport, Conn., and formerly with the U. S. Navy Department, Washington, D. C., has accepted a position as hull draftsman with the Harlan & Hollingsworth Company, Wilmington, Del.

Mr. J. S. Paaske, who has been in the drawing office of the Pratt & Whitney Company for the past five years, sailed for Europe March 11, for Hamburg, where he is to represent the machinery department of Markt & Co., Ltd., and will handle American machine tools in Germany,

Austria, Russia and France. Mr. Paaske will make his headquarters at Hamburg.

Mr. W. D. Murdock, formerly of the automatic machinery department, and more recently of the sales department, with location in the New York office of the Pratt & Whitney Company, has made an engagement with the Jones & Lamson Machine Company as manager of their business in Great Britain, with headquarters at Birmingham. He expects to sail for his new field of labor the latter part of April or early in May.

Obituary.

Edward S. Tabor, president and treasurer of the Morse Twist Drill & Machine Company, died at New Bedford, Mass., March 10.

When the greenbacks first appeared in 1862 the geometrical line engraving of the medallions containing the large numerals, and in other parts of the notes, attracted wide attention, and were supposed to be, as they probably were, the most effective means then known for baffling the counterfeiters. Andrew S. Fowle, the maker of the first "engine" used by the Government for this work has just died at Newark, N. J.; seventy-eight years old. He was born in Boston, and had lived in Newark since 1853.

William N. Woodruff, a contractor at the Pratt & Whitney shops, died at Hartford, Conn., March 10; fifty-three years old. Mr. Woodruff was born at Orange, N. J., and after leaving school began to study law. He soon found, however, that law was not in his line, and he learned the machinist's trade. He later found a job at the Pratt & Whitney shops in Hartford, and soon became a contractor there, remaining connected with the works thirty-three years, beginning as the youngest contractor and eventually becoming the oldest. He was the inventor of the Woodruff key, now well known.

By the passage of the Navy Personnel bill, Commander George W. Melville, president Am. Soc. M. E.; M. T. Endicott, Am. Soc. C. E., and Philip Hichborn become rear admirals.

The "Horseless Age," of New York, which is said to be the first motor vehicle journal printed in the English language, has recently been changed from a monthly to a weekly, which fact is indicative of the growth of the motor vehicle industry in the United States.

Owing to the recent considerable advances in the price of copper, aluminum is taking its place in some instances for electrical conductors, and we learn of a contract for aluminum trolley wire to take the place of what would have amounted to ten million pounds of copper wire.

Intending exhibitors at the coming convention of the American Foundrymen's Association, to be held in Pittsburgh during the third week in May, will please communicate with Dr. R. Moldenke, Forty-eighth street and A. V. Railway, Pittsburgh, chairman of the committee on exhibits. Applications for space will be received up to May 1.

Commercial Review.

NEW YORK, FRIDAY EVENING,
March 10, 1899.

DYNAMOS AND MOTORS.

As indicating the state, not only of the electrical machinery field but of other branches of industry, it is gratifying to record the lively demand for electric motors for factory power purposes. Represented in this market are half a dozen or more hustling companies of medium size which do a large business especially in that line. To their present good business there seems to be no exception.

Orders, as is remarked with emphasis in more than one case, are notable rather for multiplicity than for magnitude, which shows that manufacturers throughout the country are increasing their capacities to meet actual business, rather than that a few big experimental plants are being erected. Where, for instance, February and March are pronounced better months than January, and yet sales have consisted chiefly in additional purchases by old customers, the evidences of industrial growth are of a most conclusive nature. Besides their relation to general business these many small orders are beneficial for the electrical manufacturer, it has been observed, in that they afford him better profits. They avoid the necessity of shaving down margins to the greatest possible thinness, as is done where several electrical companies are competing for some big contract. There may be another side to this question, however, in greater office work required where a total value of sales is much subdivided.

In several cases it is distinctly stated that with the progress of the season business is becoming still better than at the beginning. The indications of March so far are very flattering. The work upon which one company is figuring, largely in water power transmission, leads it to believe that this may prove the biggest month on its records.

A common complaint in electrical selling circles is the difficulty of obtaining goods from the factories. Several companies are unable to make contracts in many lines on less than three months time for delivery. Some of them complain that they have had to turn down orders on this account.

A TRUMP CARD FOR ALUMINUM.

The strength developed by the copper market necessitated that manufacturers of electrical machinery advance prices last month. That such changes were taking place we stated in our last report upon the electrical market. Some concerns, however, have made no advance. The tendency of the market does not seem to be to utilize the excuse of costlier copper in making a dash toward better profits, but simply to cover increased expense of the metal without abatement of the sharp competition which long has prevailed, with perhaps a return to as low prices as ever if the copper market reacts to the old basis.

The advance in copper sets electricians to considering afresh the availability of aluminum wire as an electric conductor. For dynamo winding and other purposes involving frequent bends and joints aluminum wire is inadequate, but in long distance work this is not such an obstacle. A certain company is now figuring upon the employment of aluminum wire for a seven-mile water-power transmission over a mountain in South America. The installation is to be upon the sea coast, and, of course, the oxidization of the wire will there be somewhat greater than if it were in the interior, which is one of the things to be considered, but may not prove a serious obstacle. Assuming copper wire to be twenty cents per pound and aluminum wire thirty-five cents the electrical company is said to have calculated for the aluminum a saving in cost of some 25 per cent. in wire of equal conductivities. The use of aluminum as an electrical conductor is an old story. Some eight years ago, in the days when the Edison General Electric Company was an independent organization, that company was seized by the fad and bought a lot of aluminum wire which long lay around in the stock room unable to find a buyer. Aluminum is now in use as a conductor at Niagara Falls. The question to-day assumes a practical aspect. If copper should remain permanently as high as it is now, no doubt the aluminum people would achieve a great victory. But it is doubtful whether copper will long remain at a point materially to its disadvantage as compared with aluminum.

ELECTRICAL SIDE LIGHTS.

Street railway demand, from the standpoint of the General Electric Company, is reported very active, with no appreciable features as to season, and is running to a great number of small orders.

In the umbrage of the motor market lighting generators do not stand out very distinctly. This is not a particularly brisk season of the year for them, and the decline of isolated plant work, as a feature of the New York City trade, has long been notorious. There are possibly a few signs of improvement in this line. Some apartment houses are being erected uptown, for example, two of which, at least, are said to be future purchasers of lighting outfits. One of them has just given out specifications for a 100-kilowatt and two 50-kilo-

watt generators. An eighteen-story office building is contemplated for one of the corners of Broadway and Chambers street. This is higher than any we have heard of for some time past.

A company which manufactures a high type of alternating apparatus refers to some electrical work in prospect in Cuba, for both lighting and power purposes. It is particularly multiphase work. "Our multiphase generators are more in demand than the single phase," they remark, "for the reason that the multiphase can be used for power purposes as well as lighting. Most of the manufacturers, including ourselves, do not make single phase motors, because, except in very small sizes, which can be given an initial impetus by hand, they are harder to set in motion. The multiphase machines, like an engine with two cranks, have an advantage in starting."

"We are bidding upon a good deal of direct-connected work for factory purposes in Japan," remarks the local representative of an electric company. "The Japanese are regular parrots in their imitation of modern industries. Now they are even talking of building horseless carriages in Japan."

The Eddy Electric Manufacturing Company in its returns for 1898 found an increase of $85,000 over the preceding year. February, 1899, was about the largest month on record in the gross value of sales, a notable feature being the fact that these were composed of small orders. March has opened still better. "We have received considerable trade from New England," remarks a representative of the company. "This is not from the textile mills—which are buying very slowly, at Fall River, for instance—but rather from metal working factories, chiefly about Hartford." Orders received from the Pope Manufacturing Company for special Eddy motors for horseless carriages have footed up to 125 motors since the first of the year. Many of these are to be shipped abroad. About a carload of Eddy exciters has been sold to the Stanley Electric Manufacturing Company.

We regret to say that the Fort Wayne Electric Corporation has gone into the hands of receivers. The persons who are acting as such until the creditors meet and elect trustees are Samuel L. Morris and Charles H. Worden, president of the corporation. It is said to be likely that the company will be reorganized.

MISCELLANEOUS.

The advances in pipe fittings and other metal goods are enabling some fortunate parties to pull in profits hand over fist. One house, providently foreseeing the advance, laid in what is said to be the best stock of pipe and fittings in New York City. Where a few weeks ago the firm was profitably selling at 80 and 10 per cent. discount they are now allowing only 60 or 60 and 10.

Owing to the increased cost of raw materials the Webster Manufacturing Company has advanced prices upon its products 10 to 15 per cent. This is moderate, considering the change in the prices of materials.

The International Steam Pump Company has been incorporated under the laws of New Jersey with a capital stock of $27,500,000. The following companies will be under its control, either through the acquisition of their property and businesses or by the ownership of not less than two-thirds of their stock: Worthington, Blake & Knowles, Deane Steam Pump Works, Laidlaw-Dunn-Gordon and Snow. These companies, it is estimated, transact 90 per cent of the steam pump business of the United States, exclusive of high-duty engines, though the majority of the companies also manufacture such

(*Continued on page 40.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting, Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer. Mach. T. Co., Meriden, Ct.

Wanted—Gap lathe to take in near 30 to 60 inches. G. W. Porter, Lindsey, Pa.

Agents in every shop to sell my tools; liberal discounts. E. G. Smith, Columbia, Pa.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J. L. Lucas, Prov., R. I. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Care for your fine tools; Shaker Resolvent Cloth removes and prevents rust; half yard 20c. Winkler Chemical Co., St. Louis, Mo.

Best workmanship; reasonable charges; watch, clock and other light machinery; send for samples of punch and die work. Waltham Machine Works, Waltham, Mass.

Expert seeks tabular work; tables carefully calculated to any formula; catalogs written up; metric calculations undertaken. Wm. Cox, 15 Jaques st., Elizabeth, N. J.

Improved feed water heater and condenser, saves 33 1-3 per cent. fuel; no pipes; unrivalled; best testimonials; patent for sale or royalty. Box 177, AMERICAN MACHINIST.

Machinery Wanted—Manufacturers of steam pipe covering are in the market to buy hydraulic machinery or other kinds for the manufacture of molded coverings. Address Box 136, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Pattern maker of long experience, desirous of a change, wishes permanent position. Box 153, AMERICAN MACHINIST.

Young man with practical mechanical ability desires situation as machinery salesman. F. H. F., AMERICAN MACHINIST.

An experienced foreman on engines, general machine-shop work, desires position. Box 156, AMERICAN MACHINIST.

Position wanted by mechanical draftsman; 10 years' experience, tools and automatic machinery. Address Box 176, AMER. MACH.

Foundry foreman wishes position; experienced, heavy or medium castings; N. Y. or N. E. preferred. Box 168, AMER. MACHINIST.

Recent technical graduate desires position at mechanical drafting; salary secondary; good reference. Address Box 158, A. MACH.

First-class pattern maker wants position as foreman; Ohio preferred; please correspond. Address Box 167, AMER. MACHINIST.

Foreman pattern maker wishes a change; middle aged, good experience and best of references. Box 157, AMERICAN MACHINIST.

Wanted—Responsible position, by young mechanical engineer; four years' shop and office experience. Address Box 163, AMERICAN MACHINIST.

Young man with $5,000 to invest desires association with established manufacturing firm, preferably marine power outfits. Box 159, AMERICAN MACHINIST.

Draftsman and mechanical engineer, 20 years' varied exp., prac. designer of high-grade engines, tools, etc., desires situation. Box 29, AMERICAN MACHINIST.

Position wanted as foreman of machine shop or brass room; 18 years' experience; A No. 1 references; held last position 7 years. Box 155, AMERICAN MACHINIST.

Wanted—Position by junior A. S. M. E. graduate; experience in shop, draftsman and designer and as supt. Address Reid, Room 502, 35 Nassau st., New York City.

A good practical mechanical superintendent is open to an engagement; general and special machinery, tools, jigs, fixtures, etc.; iron or brass. Box 162, AMERICAN MACHINIST.

Wanted—Position as foreman, by first-class machinist, and also a draftsman; have had three years' instruction in mechanical engineering; can give best reference. Box 174, AMERICAN MACHINIST.

Foreman, technical graduate, 8 years' experience in jobbing shops, 3 years in pulp and paper mill construction and repair, wants position, assistant superintendent or foreman. Address Maine, AMERICAN MACHINIST.

Position wanted by a practical expert as supt. or foreman of sewing-machine, typewriter, bicycle, or such manufacturing concern; experienced in charge of men; am a practical mechanic, and capable of designing tools, jigs and labor-saving devices. Box 170, AMERICAN MACHINIST.

A first-class French machinist is looking for position to erect and operate or represent firm at the Paris Exposition, 1900; have held similar positions at Paris Exposition, 1889, and Chicago, 1893; speak English, French and Spanish fluently; best references given. Box 166, AMERICAN MACHINIST.

Wanted—An opportunity by an American man, 33 years of age, now supt. of an American manufacturing company; a chance to go abroad as representative of some company engaged in a mechanical line; advertiser is a first-class steam engineer. Address Box 179, AMERICAN MACHINIST.

Wanted—By an engineer and manufacturer in general engineering work, a position as manager of works; or would like to join a new enterprise of engineering and founding; can introduce desirable lines of specialties; has extensive experience in all departments. Address "Originator," AMERICAN MACHINIST.

Mechanical engineer and superintendent, 35 years old, technical education, with 15 years' experience in first-class shop and office management, desires a situation; Eastern or Middle States preferred; understands modern methods and how to handle men; a good manager of shop or office, and a good buyer; best of references. Box 165, AMER. MACH.

Machinery—Wanted position in export or sales department; age 36; experience four years traveling and seven years mechanical drawing, designing, building and adjusting complicated machinery; for correspondence or direct selling Spanish-American countries. have good working knowledge Spanish language. Address Box 169, AMER. MACHINIST.

Wanted—By a practical general machinist,

(*Continued on page 40.*)

(*Continued from page 39.*)

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GEARS of all descriptions

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is guaranteed to reduce your oil bills at least 50%. Ask your supply house or oil company to send you one on trial. Used by prominent firms throughout the world.

Business Established 9 Years.

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Don't Stay

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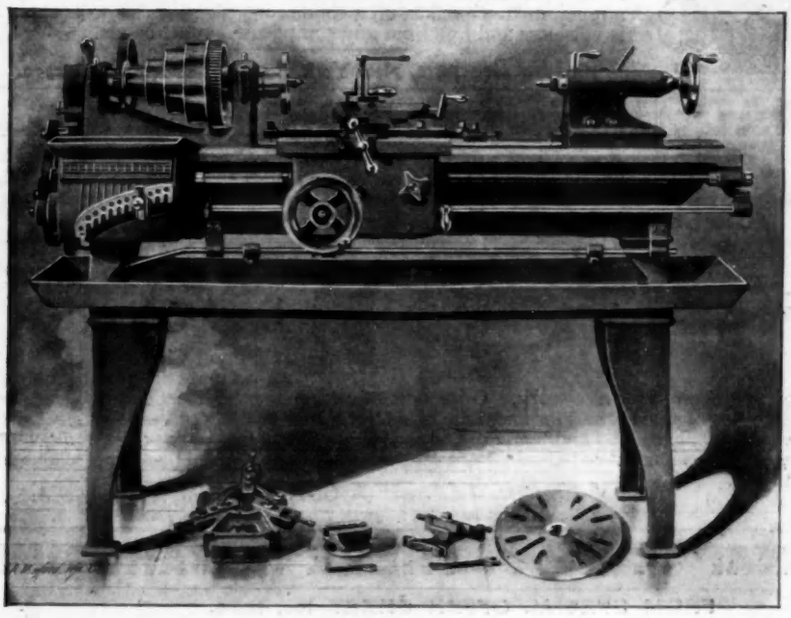

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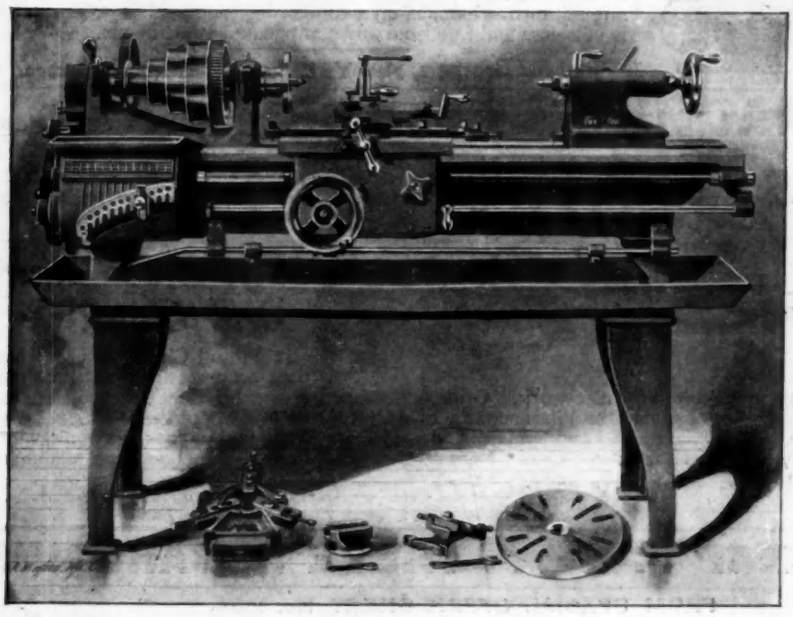

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Quotations.

NEW YORK, Monday, March 13.

Iron—American pig, tidewater delivery:—

Pennsylvania irons:

No. 1 X foundry	$15 25 @ 16 50
No. 2 X foundry	14 50 @ 16 00
No. 2 plain	13 75 @ 14 50
Gray forge	13 00 @ 13 50

Alabama irons:

No. 1 foundry	14 75 @ 15 25
No. 2 foundry	14 25 @ 14 75
No. 3 foundry	13 75 @ 14 25
No. 1 soft	14 75 @ 15 25
No. 2 soft	14 25 @ 14 75
Foundry forge	13 50 @ 14 00

Pig iron is very scarce, with prices nominal and irregular.

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c. Store prices: Common, 1.50 @ 1.60c.; refined, 1.60 @ 1.70c.

Tool Steel—Base Sizes—Standard quality 6 @ 7c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.80c., with further advances expected.

Cold Rolled Steel Shafting—Base, sizes, from store in small lots, 2.75c.

Copper—Carload lots, Lake Superior ingot, 17½ @ 17⅝c.; electrolytic, 17c.; casting copper, 16¾c.

Pig Lead—Carload lots, 4.42½ @ 4.45c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 23½ @ 23¾c., f. o. b. New York.

Spelter—In carload lots, 6¼c., New York delivery.

Antimony—In cask lots and over, 9⅞c. @ 11⅛c., according to brand and quantity.

Lard Oil—Prime city, present make, the leading brand, 45 @ 47c., in wholesale lots.

New Catalogs.

From E. G. Smith, Columbia, Pa., we are in receipt of catalog and price list of calipers, scales, micrometers and other tools used by machinists. The catalog is standard size, 3½x6 inches.

We have received from J. J. McCabe, New York, catalog in which is described and illustrated McCabe's patent two-spindle lathe, which lathe combines in one machine two sizes that are commonly used for light and heavy work. This machine can be used in place of a gap lathe, and obviates the necessity for the use of raising blocks. The machine is described in clear and concise language, and the catalog is 6¼x9¼ inches.

We have received from the General Electric Company a very tastefully gotten up brochure describing Thomson recording wattmeters. Each type of meter is so clearly described and illustrated as to be readily understood, and some valuable information on the care, connection and reading of these meters is given. A copy of the catalog will be sent upon application to the Schenectady (N. Y.) office of the company.

C. W. Hunt Company, New York, has sent us copy of its catalog No. 9902, describing steam and electric hoisting engines. The engines are massive in construction and designed to perform heavy service continuously. Their construction is gone into in detail, and the catalog is profusely illustrated, showing parts and complete engines. Most of the engines are built for use in connection with the handling of coal. The catalog is 6½x9¼ inches.

We have received a copy of the 1899 catalog of the Brown & Sharpe Manufacturing Company, Providence, R. I. The catalog contains a colored insert on which is given a list of those machines and tools added to the regular line during 1898. The catalog, as usual, abounds with good things for the machinist, and the tables of decimal equivalents, standard tapers, weights of bar iron and steel, etc., etc., are all included, which makes the catalog valuable to the workman as a book of reference. The catalog contains 445 pages, and will be mailed to any address upon application, without charge.

SEND FOR COPY—FREE.

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TELLS ALL ABOUT FILES AND HOW TO USE THEM.

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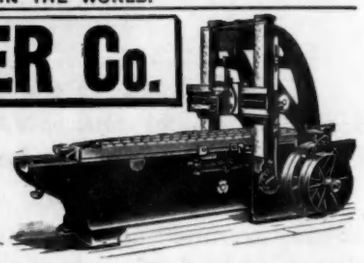

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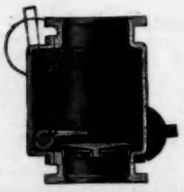

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